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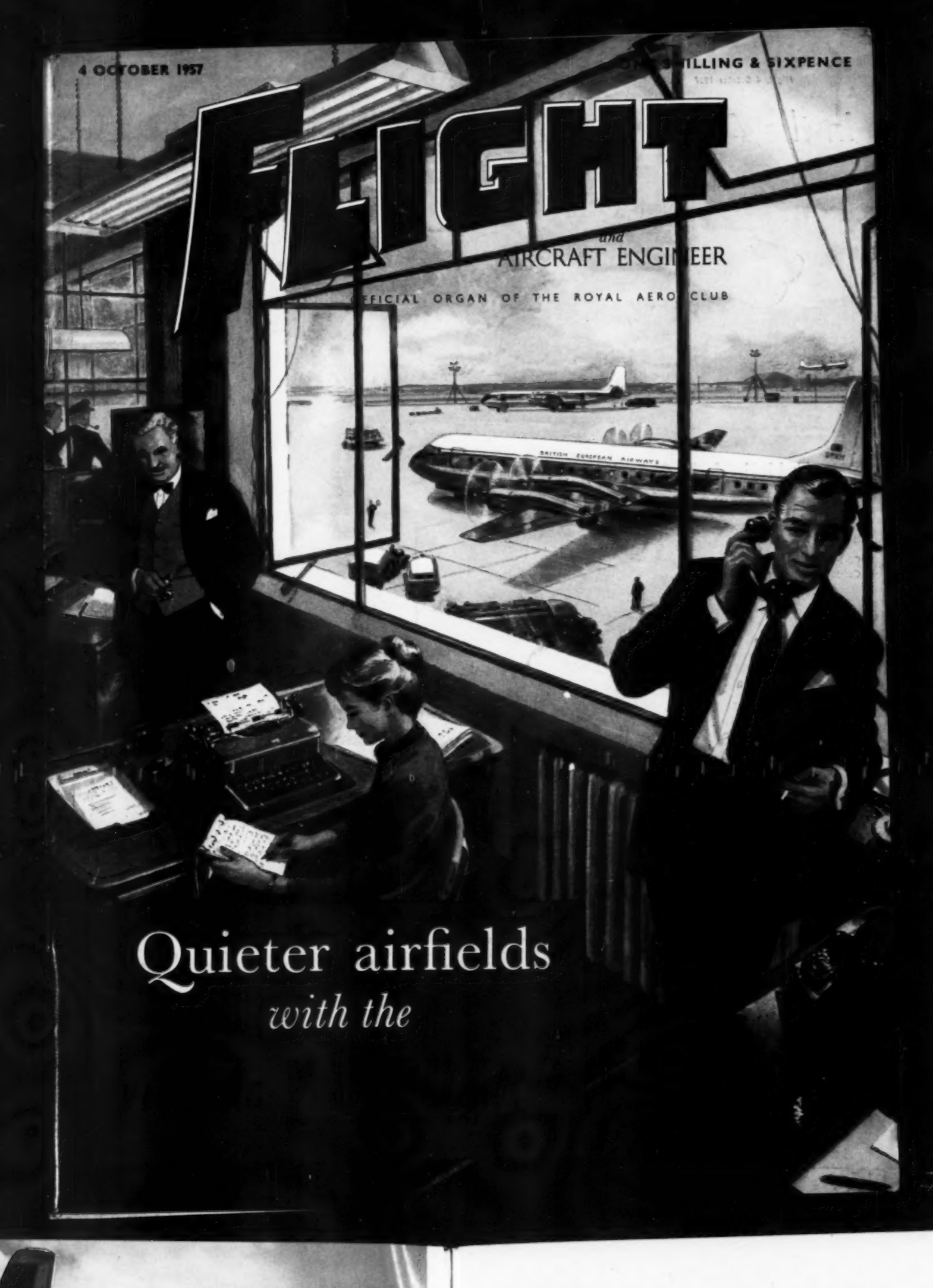

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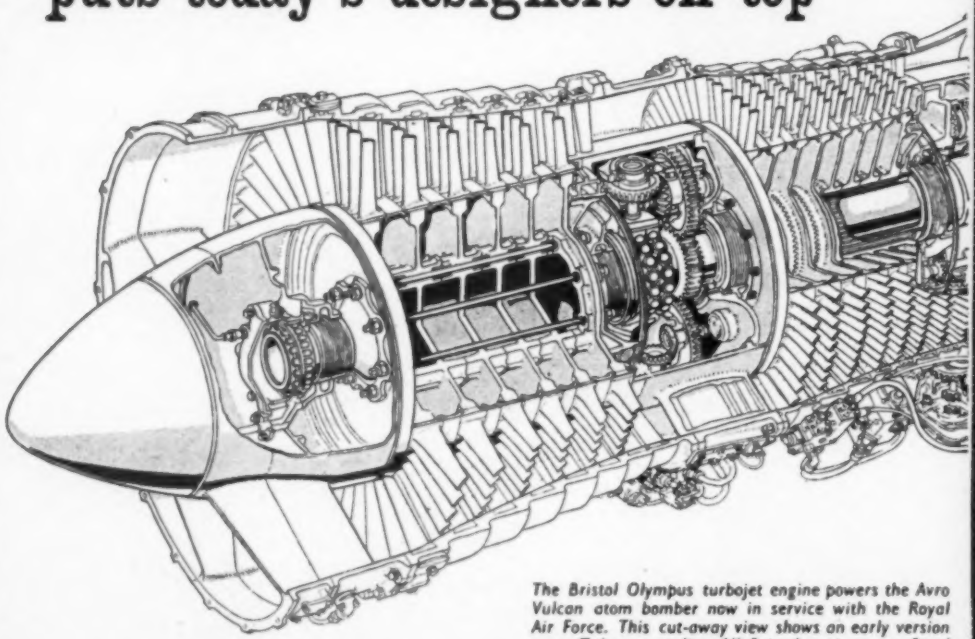

The Bristol Olympus turbojet engine powers the Avro Vulcan atom bomber now in service with the Royal Air Force. This cut-away view shows an early version now off the secret list. All Bristol engines are fitted with Ransome & Marles Bearings.

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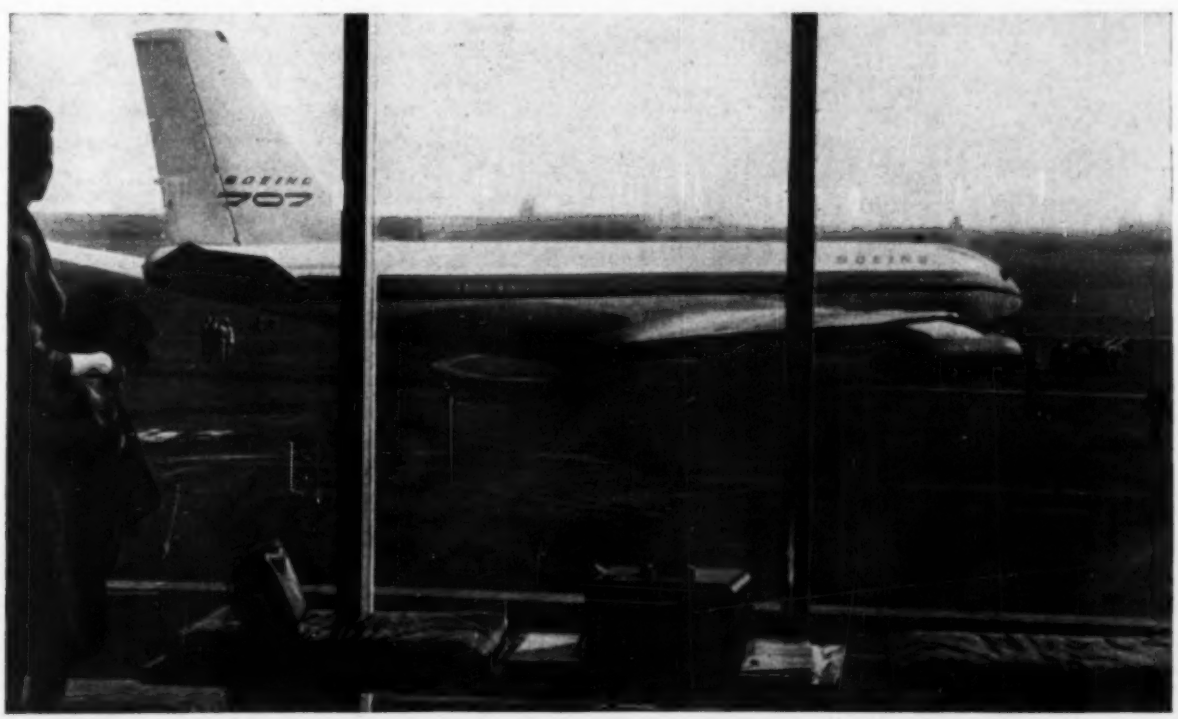

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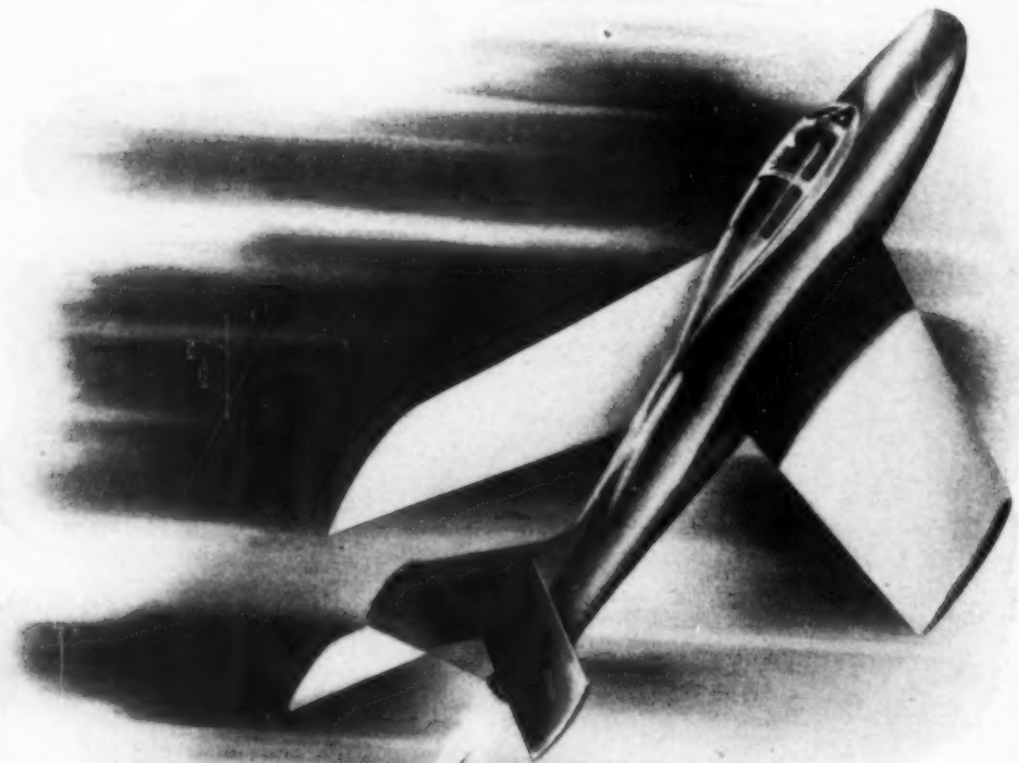

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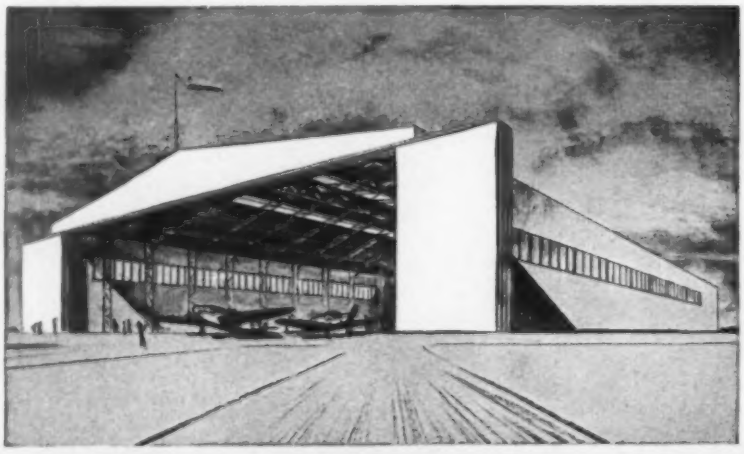

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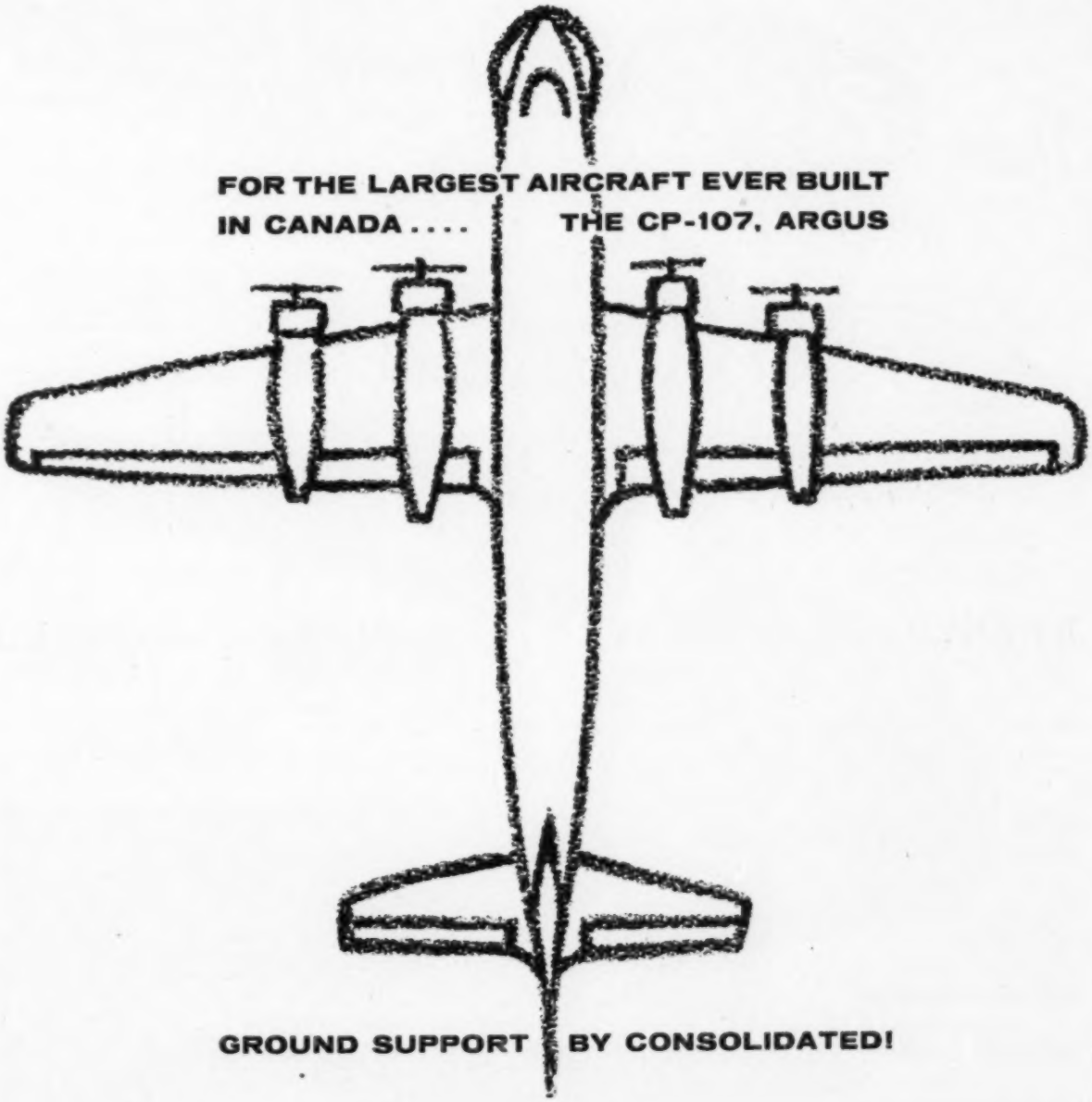

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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

No 2541 Vol 72 FRIDAY 4 OCTOBER 1957

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Thomas Skinner of Canada, Ltd.
67 Yonge Street, 1
Telephone · Empire 6-0873

New York, N.Y.
Thomas Skinner and Co. (Publishers), Ltd.
111 Broadway, 6
Telephone · Digby 9-1197

ANNUAL SUBSCRIPTION
Home £4 15s 0d, overseas £5 0s 0d. Canada and U.S.A. $15.00.

Entered as second-class matter at Post Office, New York, N.Y.

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Towards the Cataport ?

IN the multi-jet wake of the 600-m.p.h. transports a wrack of problems, some familiar, others newly recognized, is trailing ominously, and threatening to encompass the swift craft. And as the menace is seen to subside in one direction, it heaves up sharply in another. In the councils of the airlines, where only a few months back a brash confidence prevailed, a heavy anxiety is felt.

On the technical side the problems of noise-suppression and thrust-reversal are being mastered; but only with concessions in performance and simplicity. It is, indeed, the accruing complexity of the whole business—the business of introducing the "simple" jet aeroplane—that gives rise to the new malaise.

To the inventory of operational aids the braking parachute may yet be added. This week (p. 559) we write of a new silent-taxying aid; and already there is positive interest among American operators in runway arrester gear. An engineer of T.W.A., for example, declares that his airline "would like to see the development of an over-run barrier capable of stopping commercial transports." Such a device, in his opinion, could probably save "some aircraft." Then the United Air Lines' director of flight safety reports that "several proposals have been made to the airlines concerning over-run barriers," adding that the subject was larger than any one company and properly came within the jurisdiction of the Civil Aeronautics Administration. For their own part, the C.A.A. say that they have "formed no opinions concerning over-run barrier requirements for commercial aircraft"—a declaration which some would consider to smack of departmental insouciance.

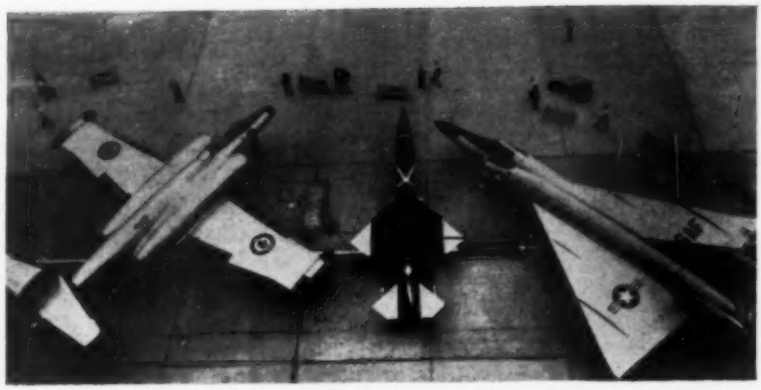
Though the operators, quite naturally, are resolved that their swift new giants shall not be subjected to the indignities and penalties of excrescences for the engagement of the barrier, the E. W. Bliss Co. (one of three American concerns prominent in the energy-absorption business) already sees as "the next step" the installation of arrester gear. And the next step to what? To something which *Aviation Week* describes as a fully integrated concept—the "Cataport"—for "boosting planes into the air, arresting them at land, and trapping them in case they overshoot."

Thus, if any speculator in these vexing days should be thinking twice about putting his money into the airline industry, he might do well to plump for machinery—in the first instance for the mixing of concrete in ever-increasing quantities; in the second for mechanical haulage; and then for the acceleration and deceleration of heavy, fast-moving bodies.

As Ithers See Us

IT is good for us all, as Robert Burns implied, to see ourselves occasionally as others see us; and two comments from abroad last week on the British aircraft industry have a refreshing tang of originality. Thus Herr Ziegler, editor of *Flug-Revue*, who not only went to Farnborough but visited factories beforehand, writes that "the compactness of the British aircraft industry is really magnificent." He says further: "If a country as small as the United Kingdom can manage to unite more than 300 entrants at a show where foreign concerns are not represented and all of which, without exception, show the most modern tools and the latest machines and aircraft, then I must say 'Hearty congratulations!' "

But by the same post, so to speak, comes Russia's first official comment on Farnborough—a typically sour remark in the Soviet Army newspaper *Red Star* that the British aviation industry is "still behind in the solution of many technical problems" and that it "needs . . . business contacts with other countries." Perhaps the S.B.A.C.—which has just published figures (see news-item on page 530) showing that aero-engine exports for August were among the highest ever recorded, almost equalling those of airframes and components—should take note. Or is it that, from Russia's point of view, we are exporting to the wrong countries? If so, no doubt British manufacturers will be happy to accept Russian orders for Viscounts, Vanguards, Britannias and Comets.



CONTINENTAL DEFENCE is the role of these three very dissimilar weapons, grouped at Boeing Field, Seattle, last month. From the left are an Avro CF-100 of the R.C.A.F.; a Boeing IM-99 Bomarc intercepter missile and a Convair F-102A Delta Dagger of the U.S.A.F.

FROM ALL QUARTERS

Engine Exports Up

FOR the first time, the value of British aero-engine exports is nearing that of airframes and components. During August, the value of engines exported totalled £3,273,631—one of the highest monthly figures ever recorded. The figure for "aeroplanes and parts" was £3,917,122; for electrical components £268,346; tyres £86,595; aeronautical instruments and apparatus £173,644; giving an overall figure of £7,719,338.

The industry's best customers during August were the Netherlands (£396,388), West Germany (£369,033), the Lebanon (£362,745) and Burma (£332,043). "It is an encouraging sign," says the S.B.A.C., "that these countries are now buying more from Great Britain than ever before."

Antarctic Rescue Attempts

EFFORTS to land fuel for the Antarctic Expedition's Auster forced down on an ice shelf by bad visibility on September 20 when going to the aid of Lt-Col. R. Smart, leader of the Royal Society's International Geophysical Year Expedition, were due to be made as soon as weather conditions proved suitable. An Otter was standing by at Shackleton base and another one at Ellsworth, the U.S. base. With the stranded Auster were the pilot, F/L. G. Haslop, and a medical officer, Dr. A. Rogers. They had survival equipment and rations for 25 days. Col. Smart sustained internal injuries from a fall on the ice.

Neville Duke Appointment

CHIEF test pilot of Hawker Aircraft until compelled to give up test flying last October by reason of spinal trouble resulting from an accident in 1955, S/L. Neville Duke is now associated with the insurance firm of Stewart, Smith and Co., Ltd. He is acting principally in an advisory capacity, particularly in the matter of jet aircraft: he will be in close contact with airlines operating such aircraft and whose insurance is handled by the company.

Stewart, Smith's deputy chairman is also a well-known aviation figure, Mr. Charles Hughesdon. The company operates a Percival Prince and S/L. Duke will be using this aircraft from time to time.

S/L. Duke's appointment to the Board of a group of engineering companies was announced last January.

Prof. Baxter Joins D.H. Engines

SEVERAL re-appointments in the technical executive of the de Havilland Engine Co., Ltd., were announced last weekend. It is also made known, as detailed below, that Professor A. D. Baxter has joined the company. The principal re-appointment is that of Dr. E. S. Moult, Ph.D., B.Sc.(Eng.), M.I.Mech.E., F.R.Ae.S., director and chief engineer, as technical director, with overall responsibility for implementing technical policy. Dr. Moult, who has been chief engineer of the company since its inception, was appointed to the Board in June 1955.

Other re-appointments include those of Mr. J. L. Edwards, B.Sc., A.M.I.Mech.E., A.F.R.Ae.S., as chief engineer (gas turbines); Mr. W. N. Neat, B.A., A.F.R.Ae.S., as chief engineer (rockets); Dr. D. M. Cockburn, Ph.D.(Eng.), B.Sc.(Eng.), M.I.Mech.E., A.F.R.Ae.S., as chief performance engineer; and Mr. W. T. Winter, A.M.I.Mech.E., as deputy chief designer, responsible to Mr. W. H. Arscott, B.Sc., chief engineer.

Professor A. D. Baxter, M.Eng., M.I.Mech.E., F.R.Ae.S., F.Inst.Pet., lately Deputy Principal and Professor of Aircraft Propulsion of the College of Aeronautics, Cranfield, has accepted an invitation to join the company as chief executive of their rocket engine division. Professor Baxter, who took up his new appointment last Tuesday at the company's engineering division, Stag Lane, will also take charge of the work of the nuclear power group.

Educated at Liverpool University and then apprenticed to the Daimler Company, Professor Baxter has had practical experience in most forms of propulsion. After a period on the staff of the Institution of Automobile Engineers, he was engaged at the Royal Aircraft Establishment on gas turbine and rocket research, becoming, between 1947 and 1957, Superintendent of the Rocket Propulsion Department. He is a member of numerous technical committees.

NATO Summing-Up

SUMMING up the Atlantic NATO exercises which were concluded last week-end, Admiral Jerauld Wright, NATO Supreme Commander, Atlantic, said: "We have shortages in the defence of Europe and shortages in the defence of North America. But we could put up a hell of a good fight." He fully supported the criticisms of forces available made by Admiral Sir John Eccles and Air Marshal Sir Bryan Reynolds—who as joint Commanders, Eastern Atlantic, directed "Seawatch." Admiral Wright further commented: "There are serious shortages in modern devices against submarine attack. There are shortages of aircraft for air defence against submarines."

Uninvited Observer

ANOTHER NATO exercise last week—Operation Deepwater, in which the U.S. Sixth Fleet was rehearsing in the Saros Gulf the defence of the Dardanelles against a supposed attacking force—was the occasion of a strictly unrehearsed incident. A "mystery twin-jet bomber, almost certainly Russian" appeared from the direction of Bulgaria and flew low over the 40-ship task force. It was thought to have been the same aircraft which had been seen shadowing the fleet from a height of 35,000ft during the previous three days.

Though the U.S. Navy issued a fairly non-committal comment ("It is presumed Adml. Brown took normal alert procedures to protect his task-force in the face of a report that an unidentified plane was flying too close to the fleet"), far more militant stories came from reporters with the force. "Two Sabre [*sic*] pilots were ordered up to intercept the plane and if necessary use air-to-air guided missiles to prevent it photographing the Sixth Fleet," said one. And another: "Adml. Brown ordered his jet intercepters to shoot down the plane with their Sidewinder guided missiles if it menaced or interfered with his ships."

Had the incident unfortunately reached any conclusion of the kind implied, some interesting points of international law might have arisen. So far as we know, there is nothing to prevent an aircraft of any nationality flying as close as it likes to a vessel, naval or otherwise, outside territorial waters. At what point such an approach constitutes "interference," and what action, if any, would then be permissible, is another highly arguable point.

U.S.A. to Build the Iroquois

AS forecast in *Flight* a month ago, Canada's mighty Iroquois turbojet is to be manufactured under licence by one of America's foremost engine constructors, Curtiss-Wright. The announcement, made by the Hawker Siddeley Group on behalf of Orenda Engines last week-end, says that the agreement is for seven years and covers manufacture, sale and further development of the Iroquois in the United States. It also provides for the exchange of technical information.

The Iroquois, a two-spool turbojet with short afterburner, has a maximum thrust of something like 22,000 lb without reheat; it is approximately 25ft in length, nearly 4ft in diameter, and weighs

MOCK-UP of the Gnat Trainer interested Air Marshal Sir Claude Pelly, Controller of Aircraft, M.o.S., during a visit last week to the Hamble works of Folland Aircraft, Ltd. Left to right: Mr. J. A. Boulger, deputy chief designer; S/L. E. A. Tennant, chief test pilot; Mr. W. E. W. Petter, managing director and chief designer; Sir Claude Pelly.

about 5,000 lb dry. It is the unit chosen to power the Mk 2 version of the Canadian Avro CF-105 for the R.C.A.F., the first prototype of which is due to emerge from the Malton factory today, October 4. A description of the Iroquois development appeared in *Flight* for September 6, and an exhibition model of the engine was one of the most spectacular features of the static show at Farnborough.

Announcing the licence agreement, Sir Frank Spriggs, Hawker Siddeley Group managing director, said:—

"This association will make it possible both for the United States and ourselves to obtain higher performance engines in a shorter period of time. Our companies will co-operate in the development of further variants of the Iroquois, suitable for the very high speed, high altitude interceptors and bombers now on the drawing-board and for commercial application.

"We are delighted that the Americans recognize that in the Iroquois, our Canadian enterprise has produced a very advanced supersonic engine. It is timely to recall that the Iroquois was started as a private venture and involved many millions of dollars before it was supported by the Canadian Government on the recommendation of the defence authorities."

Mr. Roy T. Hurley, chairman and president of Curtiss-Wright, said he estimated that the arrangement would enable his corporation's development budget to be reduced by 50 per cent, and make a high-Mach-number engine available to the U.S. Services three years ahead of schedule. The Wright Iroquois is not yet known to have any official sponsorship and will compete with such engines as the Pratt and Whitney J58 and an advanced G.E. model.

Valiant Mishap

THREE members of the crew of a Vickers Valiant on test from the R.A.E., Farnborough, last week were ordered to bale out when control trouble was encountered during the flight. Two of them broke legs on landing and had to be taken to hospital. The pilot, F/L. K. R. Sturt, and his co-pilot later landed the aircraft safely.

Frank Hillier's Illness

FROM the Air League of the British Empire we learn with regret that its secretary-general, Mr. F. N. Hillier, is still too ill to resume his duties following the stroke which he suffered over three months ago.

The chairman, Air Chief Marshal Sir George Pirie, tells us that his absence is being very much felt at a particularly busy period for the League, which is therefore seeking a suitably qualified deputy to carry on Mr. Hillier's work.

The de Havilland Strike

A MEETING of union officials concerned in the strike of draughtsmen and supervisors at de Havillands was due to be held last Tuesday, and on its decision depended whether or not the 3,000 employees involved would return to work. Last Saturday, following a decision by the Minister of Labour, Mr. Iain Macleod, to appoint a committee of inquiry into and to report on the dispute —which concerns a demand for three weeks' holiday with pay —a threatened ban on handling de Havilland components at London Airport was called off.

BRIEF BLAZE: This ballistic missile, almost certainly a Convair SM-65A (WS-107) Atlas of the U.S.A.F., was detonated by command signal a few seconds after it was fired from Patrick A.F.B., Florida. Here shown rising vertically, it keeled over at some 5,000ft, whereas it should have continued climbing for a much longer period. The firing is referred to in a news item in the adjoining column.

A.V-M. A. L. Paxton

WE regret to record that A.V-M. Sir Anthony Paxton, K.B.E., C.B., D.F.C., who, when C.O. of No. 25 Sqn. led its Hawker Furies in "tied together" aerobatics at the Hendon Displays of 1933 and 1934, died on September 25 at the age of 61. He was in 2nd T.A.F. as A.O.C. No. 85 Group from July 1945 until it was disbanded. His last appointment before retiring in 1950 was as Director-General of Personnel at Air Ministry.

Towards the Far Side

DURING the next few days the first firings of the Far Side outer space-sounding rockets should be made from Eniwetok Atoll in the Pacific. Six firings are planned altogether. Far Side is unguided and consists of several stages of solid-propellant rockets carrying a three-pound payload in the last stage. Information on cosmic rays will be telemetered back to earth.

In order to make the most of the impulse from the rockets, Far Side is to be lifted to a height of about 100,000ft by a plastic, helium-filled balloon. On a signal from the ground the rocket will fire straight through the balloon and is expected to reach a distance of 4,000 miles from the earth. It will be completely consumed by the heat generated on re-entering the earth's atmosphere. With relatively slight development, Far Side could reach the moon (hence its code-name); but without guidance a hit would not necessarily be achieved.

U.S. Missiles in the News

SEVERAL items of news concerning American missile developments have been released during the past week. The most significant is the announcement that "hardware" is being tested in quantity in the development of anti-ballistic-missile weapon systems. No doubt prompted by the news of successful test-firings of such weapons in the Soviet Union, a Washington statement says that the U.S. Air Force has in being a radar equipment capable of detecting and plotting an ICBM warhead at a range of 3,000 miles.

Using this as a basis, the U.S.A.F. and Army are preparing guided weapons named Wizard and Zeus respectively, intended to intercept the warhead at a range of several hundred miles. Overall warning time available from first detecting the ICBM would be about 15 minutes. It is reported that the new super-radars are sited on the DEW-line (distant early-warning) in Canada, north of the Arctic Circle.

Test firings of ballistic missiles continue to disappoint the U.S.A.F., who have not yet had one complete success. A picture on this page shows what is almost certainly an Atlas, which a moment after being photographed went out of control at about 5,000ft, just after burn-out of its two boost motors, and had to be destroyed. The first Atlas firing, on June 11, ended when a boost-motor propellant valve malfunctioned.

Apparently uneventful test flights were made last week by two cruise-type weapons of the U.S.A.F. A Northrop SM-62 Snark was fired from Patrick A.F.B., escorted by two "century-series" fighters, and a Martin TM-61 (similarly escorted) was flown 600 miles from Holloman A.F.B., New Mexico, to Wendover A.F.B., Utah.

Britain's Private Viscount Operator

TRANSAIR INTRODUCE TURBOPROP TROOPING

By J. M. RAMSDEN

Illustrated with "Flight" photographs

Turboprops and the Rock symbolize the new era in British air trooping movements to overseas bases.

LAST Tuesday, October 1, regular trooping moved into the turboprop era when a Viscount 804, one of two newly acquired by the small private British airline Transair, was due to begin flights to Gibraltar, Malta and Libya under contract to the Government. This article reviews the background to an event which, in a small way, makes British air transport history.

THERE appear to be two ways in which Britain's private-enterprise airlines can look at life. They can bemoan that their business is mere crumbs and sweepings from under B.O.A.C. and B.E.A. tables; or they can accept that the Corporations are an accomplished and immutable fact, and that crumbs can, by hard work and commercial courage, be transformed into bread and butter.

One independent company which takes the latter view of life is Transair, Ltd. Having last week renewed my acquaintance with them, my impression is that they typify the "damn the difficulties, let's get results" outlook which characterizes most—though not all—sections of British private-enterprise air transport today.

Ten years ago Transair were a man-and-boy outfit flying a couple of six-seat Consuls on hand-to-mouth charters. Today they are Britain's first and only private airline to operate Viscounts. I choose the words outfit and airline deliberately to show, without resort to historical detail, just how much Transair have progressed in a decade of limited opportunity for the British independents. Trim stewardesses, plushy cabins and shiny new turboprop airliners are not everything, but they are quite something when they have been earned by ten DC-3s doing Continental newspaper deliveries, seasonal inclusive-tours, and odd charters.

If you ask a Transair captain how he feels about having "arrived," as I did during a Viscount proving flight to Gibraltar last week, the reaction is one of humility rather than cockiness. "Yes, we're quite pleased with ourselves, but we're feeling our way forward very gently," was the gist of his reply. No Transair captain, I gathered, has less than 50 Viscount hours before he carries passengers: thirty-odd landings a day at Wisley, under the tutelage of Vickers pilots; was "routine stuff," and earlier this year Transair crews accompanied a number of Capital and T.C.A. Viscount delivery flights to North America. Maintenance is done at London pending the opening next spring of Transair's new £300,000 base at Gatwick.

Vickers, though apparently a little dubious two years ago about a small DC-3 operator aspiring to Viscounts, have apparently gone out of their way to get Transair off to a smooth start—and not just in their own interests. Transair people will recount in glowing terms many small ways in which Vickers have been of extra help to them.

When Transair ordered Viscounts two-and-a-half years ago (and new 800-type Viscounts at that) quite a buzz of speculation was noted in air transport circles—among independents, Corporations and ministries. How could this small firm hope to find enough work profitably to utilize two big-capacity Viscounts costing £400,000 apiece, not to mention the cost of training, and all the expense that goes with the introduction of a new aircraft? Many people assumed that Transair had their eyes on the possibility of a quick re-sale to a Viscount-hungry foreign airline; and certainly no one could have doubted that Transair were aware of this possibility when they ordered Viscounts. But when I asked Mr. G. H. Freeman about this (he is chairman and founder of Transair, and incidentally chairman of the British Independent Air Transport Association), his reply was that the last thing he had ever intended to do was to re-sell. Had he then bought the Viscounts—as long ago as early 1955—with the trooping possibility in mind? The answer was in the affirmative. "I know of no way in which you can get more than 1,000 hours a year out of seasonal flying," he remarked, "and you can't justify the expensive purchase of Viscounts just for inclusive tours and seasonal work." A simple sum shows the arithmetical sense of this: the four-month holiday season (say 120 days) cannot produce much more than 1,000 hours at eight or nine hours a day—and a Viscount must be worked at least 2,500 hours if it is to pay its way.

Obviously, there had to be a bread-and-butter line of business—with perhaps enough work capacity left over for some inclusive-tour jam in the season. And of all the bread-and-butter work which the independents enjoy, thanks to an enlightened Government policy, is the transportation of British Servicemen and their families to and from the British bases and dependencies between the West Mediterranean and the South China Seas. For example, Airwork and Skyways troop to Ceylon, Singapore and Hong Kong with Hermes; Air Charter do Cyprus with DC-4s; Eagle provide a regular inter-island Mediterranean trooping service and also serve British West Africa with Vikings; and Britavia serve Aden and Nairobi with Hermes.

Until last Tuesday, when their Viscount service to Gibraltar was due to be inaugurated, Transair had not been in the trooping picture. (For a reason which I have never been able to discover, DC-3 operators have never stood much chance of trooping.) How did Transair, a newcomer to trooping, get into this keenly contested business? The simplest answer is that they were able to offer Viscounts; but, as I was to appreciate in the course of conversation with Service officers who were fellow-guests of Transair, the award of a trooping contract involves quite a ritual—as I suppose do all commercial contracts between the Government and private firms. One Air Ministry official summed it all up as "a quest for the best service at the cheapest price, but not just the cheapest service." When someone remarked, with an inexcusable Americanism, that the troops who will fly in Transair Viscounts will have never had it so good, he agreed: but he pointed out that such an observation did not do justice to the part that the Treasury played in these matters. Indeed, I was to gain the impression that the Treasury do not only play a part: they are the judges and final arbiters of what constitutes "the best service at the cheapest price." The influence of the Treasury powerfully dominates every negotiation. Even without Treasury influence, the tender and quotation procedure would be complex, involving as it does initial agreement on movement-requirements between the three Services, who are in turn answerable to the Air Ministry, the Admiralty and War Office, all three of whom must agree on overall policy in military times which are, to say the least, politically uncertain. With Treasury influence as strong as it is, the complete trooping-contract procedure possibly constitutes the most complex method of obtaining air transport business known to man.

Transair's first Viscount 804, G-AOXU, seen at Gibraltar at the end of its first proving flight from London on September 24. The aircraft had been delivered on September 17, followed by Transair's second on September 23. A third Viscount 804 has been ordered.

A unique trooping feature in Transair's Viscounts is this four-cot créche up forward, where there is also a separate section for mothers. The main cabin accommodates 58 rearward-facing, adjustable seats (by Flight Equipment); these are all five-abreast except for eight seats aft, with tables, reserved for senior officers. (Right) The scene at Gibraltar as the chiefs of the three Services greet the arrival of the Viscount.

But it is hardly necessary to say that it is business worth having. At the moment, trooping accounts for about two-thirds of the independents' total revenue, and although the revenue rates are low, the operational attractions are high. As I had expected, actual revenue-rates are secrets guarded closely by both sides; but even if such rates could be disclosed, they would not reveal much about the profitability of trooping, which is a kind of business one cannot compare with normal airline work. The only possible comparison became apparent to me when a Transair man, asked whether his firm's lack of trooping experience would be a handicap, said: "What's so different about troops and their families? They haven't got two heads." But in every other way trooping differs from the commercial cut and thrust of normal airline work.

Take, for example, Transair's new operation ("West Med," as it is called). On about fifteen days of this month their coaches will take aboard at the Hendon air trooping centre a full Viscount load of 58 Servicemen (mostly sailors), their wives and children and baggage—all assembled and prepared—and will fly them from London Airport to Malta *via* Nice. The aeroplane will also be filled on the return flight. Similarly, on five days, there will be Army, R.N. and R.A.F. movements to Gibraltar *via* a refuelling stop at Bordeaux or Toulouse. On six days there will be Army and R.A.F. movements to Idris (Libya) *via* Malta; and on four other days there will be Army and R.A.F. flights to Benina (Libya), also *via* Malta. No advertising costs, no sales effort, no load-factor problems, no peaks, no no-shows, no cancellations—just the operational dream of a regular, round-the-year service with every seat filled.

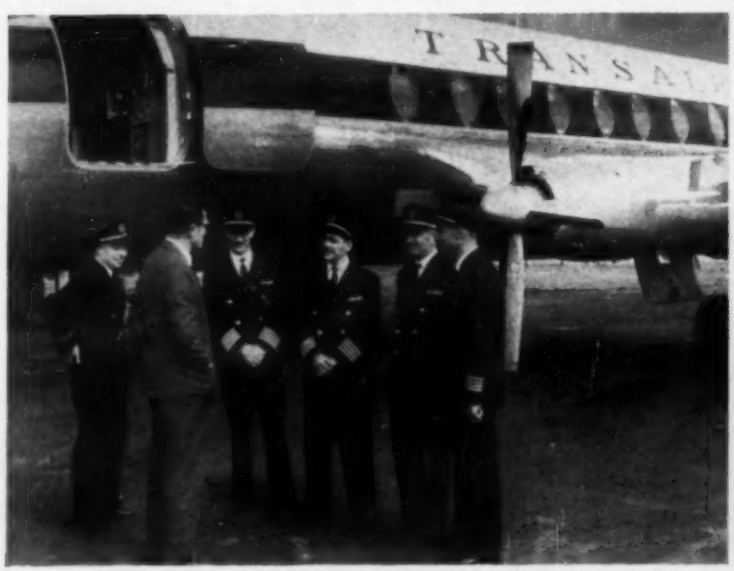
Transair's West Med contract extends for the usual trooping period of one year, with the customary (and invariably exercised) option of a further year. Of course, this is not much to plan ahead on, but it is as much as any independent can reasonably expect in these present times of uncertainty in the domestic and international political scene.

Transair will, at the rate of 25 to 35 trooping flights a month during the next two years, get about 2,000 hours a year out of each Viscount: they have hopes—if their applications now before the Air Transport Advisory Council are approved—of adding a further 400 hours per year per aircraft on seasonal inclusive-tours to such resorts as Tangier, Sicily and Nice. They may perhaps find a further 100 hours per aircraft on other work, thus producing an annual utilization of 2,500 hr. Transair reckon that their two present Viscounts, at 5,000 hours a year together, will do the work of 20,000 DC-3 hours, which is very nearly what their fleet of ten DC-3s actually achieve. Thus one Viscount 804 is worth nearly five DC-3s in earning power, or—put another way—a revenue-hour in a Viscount is worth five in a DC-3. I asked whether the trooping revenue per hour would therefore be five times higher. The answer was no.

The purchase of a third Viscount 804 is now confirmed—for delivery next April—suggesting considerable expansions in Transair's commercial business or, more likely, the taking over of certain DC-3 work.

Though Transair, with a payroll of about 500, may be one of the smaller independent stars, they are certainly one of the brightest. They may have had a certain amount of luck in becoming Britain's first independent Viscount operator, but this does not diminish the hardness of the fight that has secured them a small place in history. Big changes are afoot in the independent scene—in equipment, operations and mergers: and because Transair typify the best independent spirit, it seems appropriate that they should have been the first harbinger of long-sought changes.

Mr. G. H. Freeman, Transair's chairman, with his senior crews during a refuelling stop at Toulouse. From left to right: Chief Radio Officer W. Florey, Capt. A. Lawson, Capt. C. Coates, Capt. G. Thomas, and Transair's chief pilot, Capt. S. Websper. (Right) Three stewardesses will be carried on trooping flights. The four girls on the first proving flight were (l. and r. below) June Backshall and Pamela Burden, and (l. and r. above) Josephine Johnson and Barbara Lawry.



ARMSTRONG SIDDELEY

LOCAL COLOUR: New Guinea natives pose in front of the E.P.9 when Mr. Beverley Snook landed at the Berema mission station, 120 miles from Port Moresby, during his recent successful Australasian sales tour.

HERE AND THERE

More Sabres for R.A.A.F.

ORDERS for additional Avon Sabres for the R.A.A.F. have been placed by the Federal Government with the Commonwealth Aircraft Corporation. This announcement follows the decision not to proceed with orders for the Lockheed F-104 Starfighters, which are considered unsuitable for Australian requirements.

Dutch Sea Hawks

THE first Sea Hawk squadron of the Royal Netherlands Navy—No. 860—was officially formed at Valkenburg on September 18. During the war, this squadron was based in the United Kingdom and was equipped with Fairey Swordfish. In post-war years it has operated from the aircraft carrier *Karel Doorman* with Fireflies and later Sea Furies. No. 860 is the first Dutch naval air squadron to be equipped with turbojet aircraft.

No Prototype

WHEN Mr. Peter Twiss, chief test pilot of Fairey Aviation, was flying on September 25 in the S-51 helicopter normally used by the company for transport and training, its engine cut at 100ft and the aircraft made a heavy landing. Twiss was unhurt but damage was caused to the undercarriage of the machine—which was *not* (as was very widely reported) "a Fairey prototype powered by jets at the tips of the rotor blades."

Carrier Pigeon Technique

MESSAGES which would normally have been transmitted by radio had to be collected by helicopter from NATO ships during recent exercises. They were then flown by another aircraft to Bodo in Norway and thence by U.S. Navy aircraft to London. This method had to be used because only high-priority signals could be passed by the U.S. cruiser *Albany* (acting as Press guardship), owing to a radio black-out attributed to sunspots, which have interfered with world communications.

"FLIGHT" Next Week

BUSINESS, touring and agricultural aircraft will be the subject of next week's (October 11) issue of *Flight*, and this enlarged special number will include an illustrated review of current aircraft, British and foreign, in these categories. Among other features will be a description of the Rolls-Royce Avon 200 series turbojet.

Mirage Attains Mach 1.8

USING its SEPR rocket in addition to its SNECMA Atar turbojet the Marcel Dassauet Mirage III mixed-power intercepter has achieved a Mach number of 1·8 in level flight. The pilot was Roland Glavany.

R.Ae.S. Commonwealth Lecture

ORIGINALLY announced by the R.Ae.S. for October 17, the British Commonwealth Lecture by Mr. B. S. Shenstone on *Why Airlines are Hard to Please* has had to be postponed. Thursday, March 27, has been fixed as the provisional new date.

New Australian Weapon

AN anti-submarine air-to-sea torpedo developed by the Royal Australian Navy has undergone successful trials. Announcing this in Canberra last week the Minister for the Navy, Mr. Charles Davidson, said that details were secret but it had "remarkable striking power and could be launched with great accuracy." The new weapon has been designed primarily for use by Gannets.

The Blunt End

AN Air Ministry "order to R.A.F. engineers" (as quoted in a newspaper recently) says: "The end opposite to the front of an engine shall be called the rear."

High Weather Research

A REPORT from California makes the claim that a meteorological balloon released from Oakland Airport on September 21 reached a height of 138,000ft in 93 minutes.

R.C.A.F.-U.S.A.F. Liaison

TWO Ottawa-based CF-100 squadrons are sharing "an extensive six-week workout" with U.S.A.F. squadrons at Ernest Harmon Field, Newfoundland, as part of closer liaison for North American air defence. No. 428 Sqn. was due to complete its three weeks on October 2 and to be followed by No. 410.

By Another Name

WHEN the next British Plastics Exhibition is held—at Olympia, London, June 17-27, 1959—it will be renamed the International Plastics Exhibition and Convention. The fifth event of its kind, and the second to show international exhibits, it will again be organized by our associated journal *British Plastics*, with the full support of the British Plastics Federation.

PARACHUTISTE L. Maznichenko (right), one of Russia's most successful delayed-drop exponents, checks over her two packs during the recent Ukrainian contest.

VANTAGE - POINT chosen by landscape painter Claude Muncaster, commissioned to depict Hepworth and Grandage's new works at Bradford, was an Agusta-Bell 47G of Helicopter Services, Ltd. Lt-Cdr. C. Bateman (on the right) was pilot.

ARMSTRONG SIDDELEY

Flight, 4 October 1957

Design

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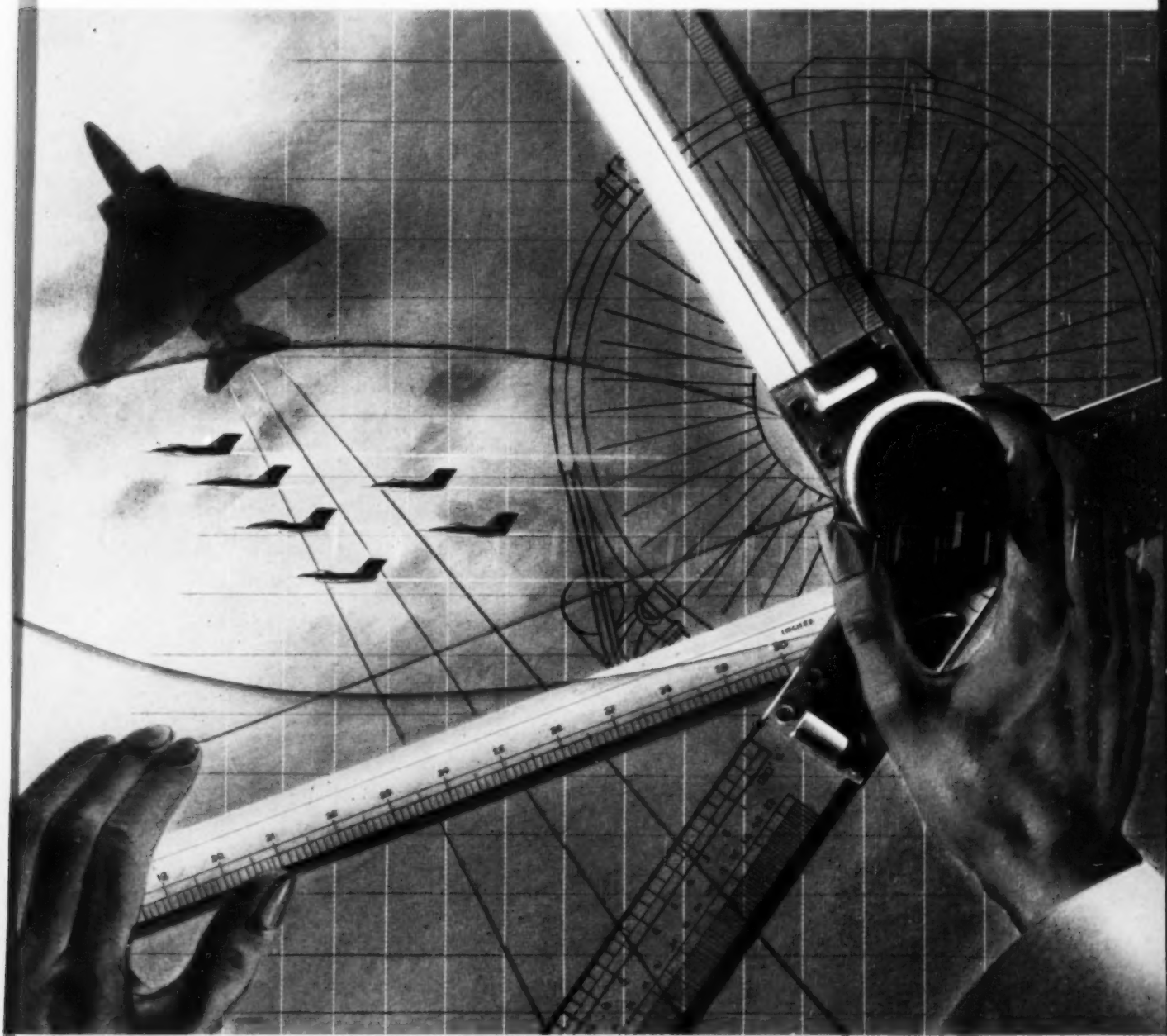

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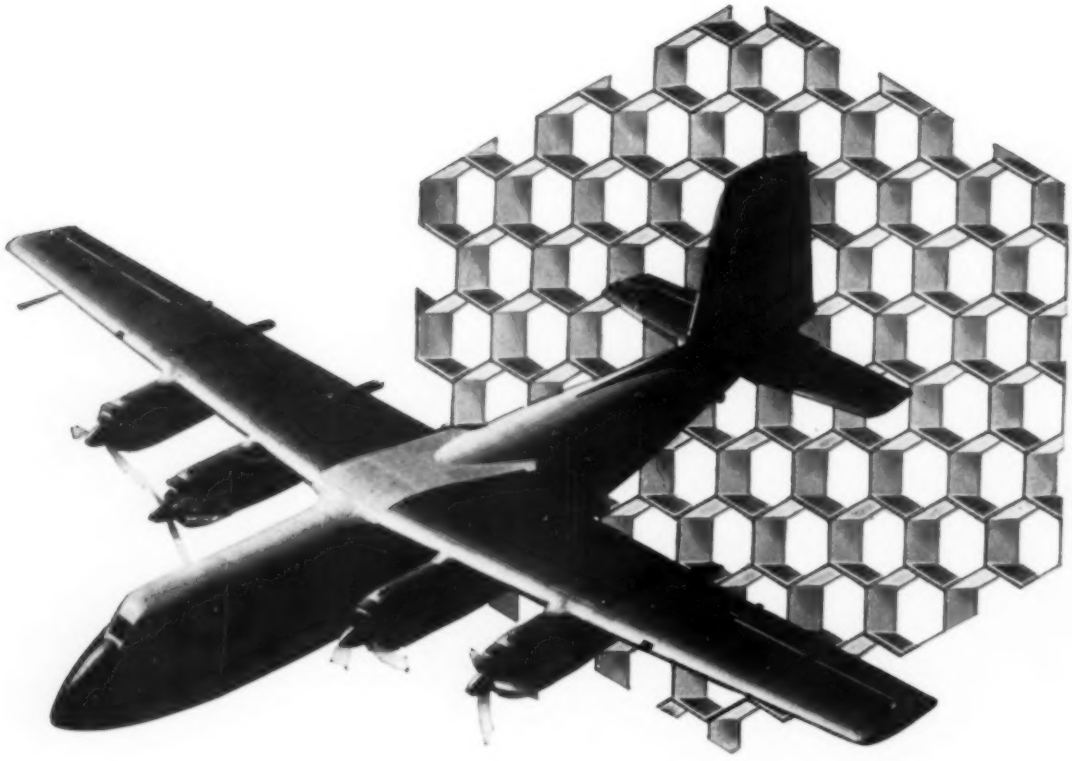

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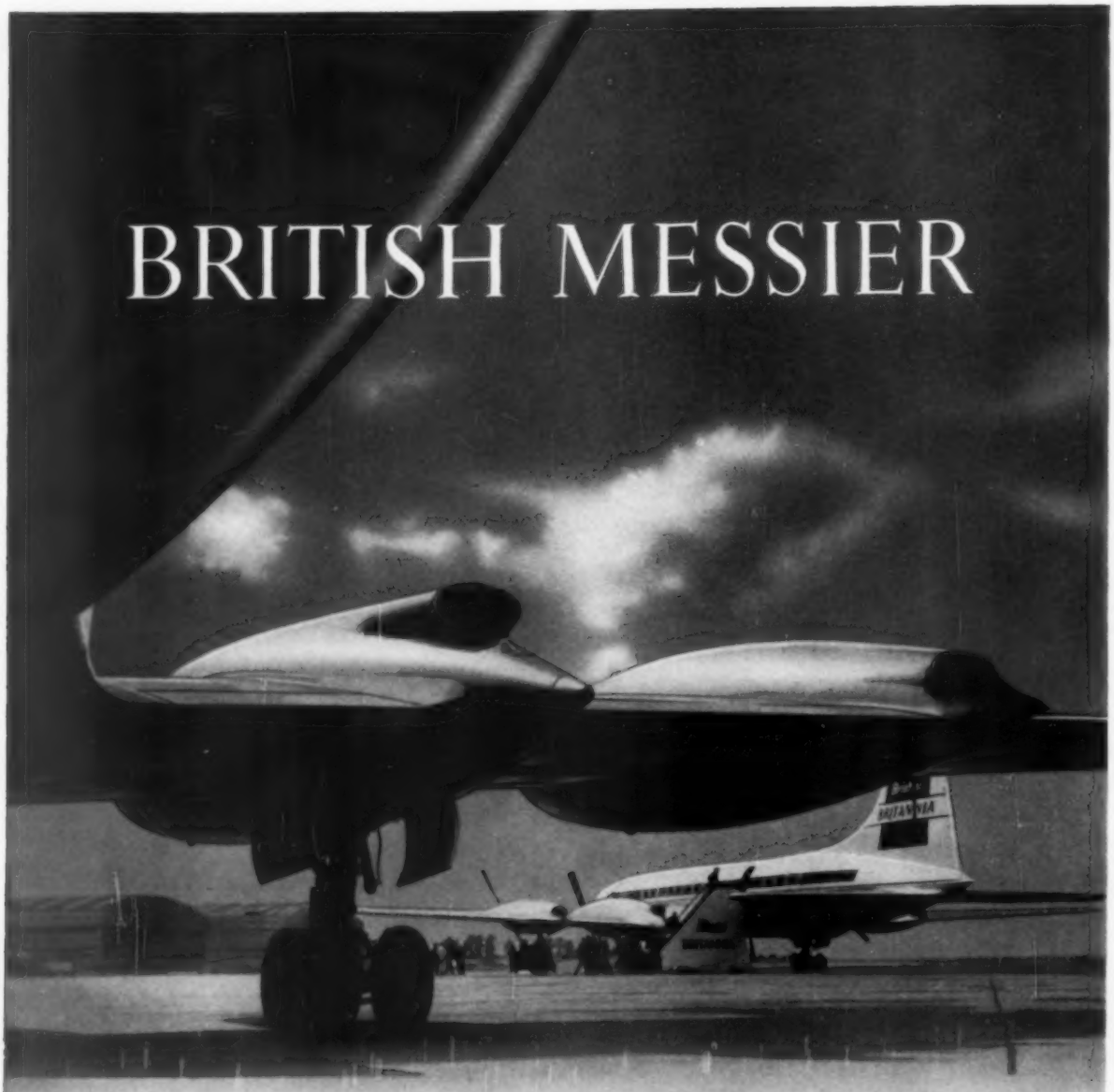

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Being serviced just before another operation to accumulate Avon hours is G-AMXD: the M.o.S. Comet 2E which is being operated by B.O.A.C.

B.O.A.C.'s Comet 2E
Flight in Operation

"FLIGHT" PHOTOGRAPHS

Callsign Jet Speedbird

THE return flight to Beirut of a B.O.A.C. Comet 2E from London Airport on Monday, September 16, announced that the Corporation's Comet Flight was back in business again. By the time flying began, of course, the revived unit was able to look back on some months of preparatory work: it was towards the end of last year that Capt. A. P. W. Cane formed the nucleus of a small unit to look after B.O.A.C.'s interest in the Comet 2E. In March of this year, ten captains and four engineer officers attended technical courses at Derby and Hatfield, and the team at present consists of three complete crews and two spare men, a category in which Capt. Cane modestly includes himself. Under him are his deputy officer, Capt. T. B. Stoney; Capt. H. J. Field, with a performance responsibility; and Eng/Off. J. Kingston and R/Off. R. J. Dolman, to attend to engineering and radio matters respectively. All the crews have had previous Comet experience, operating with the Comet 1 until it was withdrawn in April 1954. One of the team is Capt. E. E. Rodley, who has been engaged on Comet work since the project started for B.O.A.C. in 1949.

The first aircraft, G-AMXK, was delivered (flown by Capt. Cane) from Hatfield on August 26, and the second, G-AMXD, followed on August 29. Both Comet 2Es are fitted with Avon RA.524s—civil RA.29s—in the outboard position; the former aircraft belongs to B.O.A.C. and the latter to the Ministry of Supply. The object of the present exercise is not so much to fly the Comets as the Avons, in order to work-up to a reasonable life in as short a time as possible engines of the type which will power the Comet 4.

Bearing in mind flight-time limitations and suitable destinations, each aircraft puts in about 11¼ hours every time it flies: six trips a week now, and eleven a week in November when more crews become available, will enable the total number of Avon hours to reach 3,500 by the end of May next year. From this total it is hoped to raise the overhaul period on two engines to 700 hours. Close programming and a small float of eight RA.524s will be used for this purpose; the first and second engine will be drawn at 250 hours, third at 350 hours, fourth at 450 hours, sixth and seventh at 600 hours and so on, with time-expired engines being despatched to Rolls-Royce at every stage for an A.R.B.-inspected strip and reassembly—a process that will take about five to seven days. Where possible, intermediate strips such as those scheduled to be made at 450 hours will be by-passed.

Beirut was chosen as a daily destination because it is about the right distance (1,980 n.m.) from London Airport and, as Capt. Cane put it, "There are obvious advantages of operating within the local area." Not that Comet spares have been stockpiled at Beirut; only hydraulic fluid, batteries, tubes and tyres are kept there. Spares provisioning is made at base, or in a spares pack weighing about 1,200 kg carried in the aircraft. Some freight and mail may occasionally be uplifted to offset part of the cost of the operations, but none has been carried so far and payload is merely an adjunct to the primary purpose of the work. On the first return flight from Beirut, 75 kt headwinds were encountered on one sector, and one-stop operations, refuelling at Rome (and imposing flight-time restrictions), may be necessary during the winter.

A number of circumstances have combined to prevent the use of Beirut with the regularity originally envisaged. The first of these was that, after two days of operations, problems raised by the labour troubles at de Havilland caused the flight for September 18 to be cancelled, and on the following day a NATO exercise in the area effectively closed-off altitudes from 28,000ft and above until September 28. During this time, airborne hour-seeking flights were made *via* Shannon to Bilbao, in Northern Spain—a distance of about 1,920 n.m. Most of the flying is being done on B.O.A.C.'s own aircraft, G-AMXK, in order to accumulate sufficient hours to despatch to Rolls-Royce the first engine to be changed during the first week in October.

There are naturally many facets of this engine-proving operation which will provide valuable experience for Comet 4 services, and the 2Es are being used as representative test-beds for various electronic and radio equipment, although—with a crew of two pilots, a first officer and engineer—a radio officer is not normally carried. Under development or evaluation for Comet operations

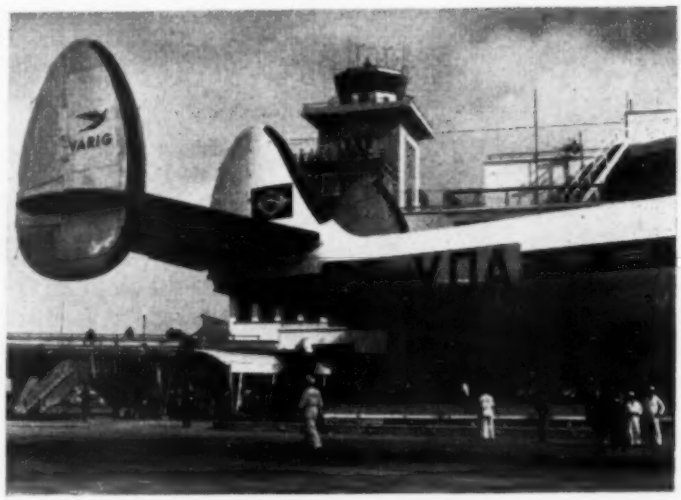
(*Continued at foot of page 538*)

In charge of the Comet unit is Capt. A. P. W. Cane, who is at the controls (right). The aircraft are loaded (below) only with spares packs; during the flight the crews cater for themselves.

FLYING DOWN TO RIO

By J. de CROZE

—modern Version: The Operations of Brazil's VARIG Airline



Super Constellation on the VARIG Brazil-U.S. service at Congonhas Airport, Sao Paulo.

FOR those of us who matured in the cinema hot-houses of the 'thirties, the phrase "flying down to Rio" may conjure up a phantasy of cumulo-nimbus clouds, gay and fatuous chatter, and magnificently improbable aeroplanes with a passenger list composed simply of Fred Astaire, Ginger Rogers, an eighty-piece orchestra, and a host of chorus girls nonchalantly tap-dancing their way to Brazil on the wings of an unidentifiable aircraft. Again, it may bring to mind those persistent travellers to Rio—the brilliantly blonde Alice Faye, the irrepressible Carmen Miranda with the entire merchandise of a Copocabana fruiterer atop her head, and the dashing "Latin," Cesar Romero.

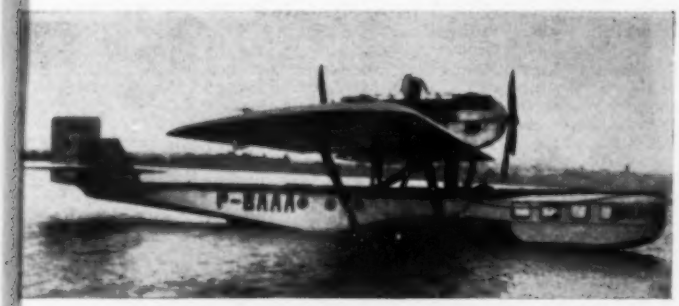
Alas, the entire population of South America no longer turns out in extravagant costume to greet arrivals at Santo Dumont airport with dances and perpetual *carnaval*. In this more sober era, Brazilians are extremely conscious of the fact that they have inherited a nation to build and that they are in the process of doing it. The catchwords are build and develop—off with the o!d, on with the new. In such an atmosphere and in a country the size of a continent but devoid of practically any surface transport, either rail or road, the obvious answer to one aspect of the problem has been to use aviation in every possible manner. Not only to bring together the far-flung provinces, but—in the way the wagon-trains had done in the United States and the railways in Argentina in the nineteenth century—to bring population itself and the means of its subsistence to the hitherto uninhabited interior.

Only fifty years ago, with the exception of long-dead gold mining towns and of the dying rubber-boom settlements of the Amazon, there were no settlements of any considerable size away from the coastal fringe. Beyond, for 3,000 miles in a straight line, all was unexplored territory. Today, thanks largely to aviation, new inland cities have already 100,000 inhabitants, like Goiânia, or over 300,000, like Belo Horizonte; and the most remote outpost can be reached from Rio within a day. Most significant in this respect is the creation of the new capital of Brazil, Brasilia, almost in the geographical centre of the country.

The first domestic airline to be opened in Brazil was VARIG Viaçao Aérea Rio Grandense). This year it celebrated its 30th birthday, and is thus one of the world's oldest. It was founded in May 1927, in Pôrto Alegre, the capital of the important south Brazilian state of Rio Grande do Sul, an agricultural area of temperate climate and hard-working Germanic and North Italian settlers. There were no airstrips then where landplanes could operate to and from, though, fortunately, there was an immense lagoon, half the size of England, stretching from Pôrto Alegre to Pelotas, the state's second largest town, and to Rio Grande, its main harbour and meat-packing centre. But at that time the Kondor-Syndikat's Dornier Wal seaplane *Atlantico*, was making successful demonstration flights in Brazil; and the nine-passenger, twin-engined aircraft was bought by VARIG and duly registered on page 1 of book 1 of Brazil's virgin Air Register. The Pôrto Alegre to Pelotas flight becoming the first scheduled Brazilian domestic run.

By 1932 VARIG could change over to landplanes—Junkers F.13s, D.H. Dragons, and eventually Ju52s—using fields and other primitive runways to bring the scattered market towns within easy reach of the capital for the first time, and to open areas of the interior where nothing but bullock-carts and canoes had ever been seen before. In that year 1,500 miles of routes were created. Four years later, passenger, mail, and freight traffic had reached sufficient proportions for the Pôrto Alegre to Pelotas run to become

Santos Dumont Airport, Rio de Janeiro. The tall buildings in the foreground occupy the former site of a mountain levelled to supply earth for constructing the airport.



VARIG's Dornier Wal "Atlantico," the first passenger aircraft registered in Brazil (1927).

the first daily flight in Brazil; and the company embarked on an expansion programme that has not slowed down since.

Just preceding and during the war years, VARIG, at its own expense, built and equipped landing-strips, created weather stations and an entire radio and telecommunications network, pioneered flight-safety equipment, and installed night-flying facilities at 19 airports. DC-3s and C-46s were put into service and proved a god-send; night-mail services were inaugurated and the first tourist-class services launched. With typical Southern Brazilian thoroughness and patience, as well as provincial patriotism, the company established a remarkably solid base before venturing outside the limits of its home state. This it did first in 1942, not to other Brazilian states, but to Montevideo, the capital of the neighbouring Republic of Uruguay. Rio was reached only in 1946, and then the other two southern states, Santa Catarina and booming Paraná, were covered with the kind of network VARIG had pioneered in Rio Grande do Sul—a more arduous task since these two states are very mountainous and covered with dense forests and lie within the troubled atmospheric belt between the temperate and sub-tropical zones.

In 1952 VARIG added a 3,500-mile route to Brazil's third main area of population, the coastal cities of the north-east, and in 1954 its second international service (to Buenos Aires). In 1955, a Pôrto Alegre - Rio - New York route, operated with Super-G Constellations, was opened, becoming the company's luxury flag-service incorporating all the trimmings of "gracious living" aloft. Supporting this new effort to realize the fabled sumptuousness of the Astaire-Rogers era is a particularly active public relations drive which sees to such things as the invitation of film stars and international celebrities. VARIG has already a sales and prestige office in Zurich and is about to open another in Tokyo. Next on the agenda are certain complementary domestic routes, including one to Brasilia, and eventually routes to Europe and the Far East.

The progress story on the traffic side is paralleled on the maintenance as well as on the administrative sides. VARIG now has a staff of 3,800. The maintenance base, which has been kept at distant Pôrto Alegre because of its spaciousness and favourable working conditions (unobtainable in either Rio or Sao Paulo), is of high international standard. A side-line is a section where government training and flying-club aircraft, which are used until they literally fall to the ground, are sent from all over Brazil for complete rehabilitation. A unique aviation school—flying and engineering—was added in 1951. On the administrative side, this pioneering company is distinguished by a shareholding structure in which half the total shares are held by an employees' foundation which offers benefits ranging from pensions and medical care to holiday resorts. The remainder of the shares are held 35 per cent by the employees themselves, 10 per cent by private holders, and 5 per cent by the State Government. Shareholders, obviously patriotic, forgo their dividends so that all profits may be ploughed back for development.

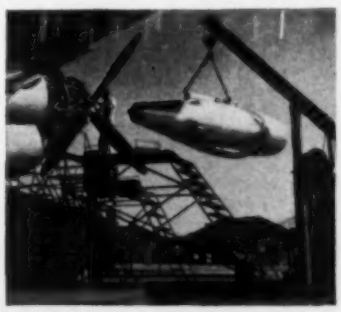
VARIG statistics for 1956 were: passengers carried, 511,414 (up 26 per cent over 1955); freight, 17,000,321 ton-km flown (up 15 per cent); km flown, 18,467,982; hours flown, 67,000; extension of lines, 30,024 km; staff, 3,800; fleet, 23 DC-3s, 14 C-46s, five Convair 240s, three Constellation L.1049Gs.

Brazil is now covered by a dense network of internal air routes operated by six major airlines. Passenger services have three classes: first, carried in Convairs or Constellations; tourist, in DC-4s, Scandias, and C-46s; and third in DC-3s, with maximum seating in C-46s. The fare structure, enforced by the Diretória de Aviaçao Civil, is related to a basic rate of about 5d a mile, first being set at 5 per cent above basic, tourist at 10 per cent below, and third at 20 per cent below.

On this network, a dozen trunk routes (short and medium hauls) linking the provincial capitals and chief commercial cities, stand out. The rest of the system, unglamorous but as vital, is the amazing "countryman's" network, interlinking almost every little town, settlement, or outpost on the huge map of Brazil. This sector, on which are flown rather more than half the total number of hours flown in Brazil, and to which the Brazilian airlines bring the technical and financial power earned on the more profitable trunk routes, provides such freight and passenger transport as in most other countries relies on buses, trucks and local trains. It has an unfrivolous *clientèle* of farmers, cattlemen and traders to whom flying, in spite of its relatively high cost, is the only economic manner of transport. Hops are sometimes as short as 50 miles, runways mostly poor, and the latest standards of flying comfort obviously not expected nor required. It is not surprising that these services should be operated almost exclusively by the faithful DC-3s. The directors of VARIG—which has 23 such aircraft—actually plan to use them for another ten years. It is also an ideal area for the retirement from the trunk routes of such aircraft as the C-46.

It is in relation to the domestic trunk route network that the interesting topic of replacement first comes up. This part of the network resembles more the European or North American pattern, with 200- to 900-mile hops between cities of substantial importance. It includes the prize short-haul, Rio - Sao Paulo, which has the world's second highest frequency, with aircraft leaving every 15 minutes in both directions. On its trunk routes, VARIG at present employs Convair 240s, and C-46s fitted with Palas auxiliary jet pods. It is on this sector that VARIG has introduced two novelties to Brazil: the business-man's or after-dark non-stop services between two such distant points as Pôrto Alegre and Rio, and the

(Left) VARIG's home base—Pôrto Alegre, South Brazil.



(Right) A Turboméca Palas A.T.O. jet pod being mounted on a C-46.

Passengers embarking on a Convair 240 "business-man's flight" at a South Brazilian airport.

FLYING DOWN TO RIO . . .

all-cargo services. For the latter, C-46s are also used; but the volume carried is now such that a specialized aircraft might be welcomed. All kind of freight is carried with the exception of livestock, which is handled by special companies. There is no such thing as car-ferries, but the transport of cars is of especial interest—although rates are not cheap: e.g., £60 for a Ford Prefect from Rio to Pôrto Alegre, a distance of 900 miles. (This, however, must be seen in relation to the roads, which on this route necessitate a week of exhausting driving and result more often than not in damage to a vehicle that may be worth three times or more its European price.)

As far as passenger traffic on these trunk routes is concerned, comfort and speed are requisites; this sector is one on which the appeal of new aircraft cannot be ignored. VARIG had been interested in Viscounts from the start—as a corollary to its interest in the first Comets—and has had a total of eight on order. Owing to the possibility of foreign exchange being made more expensive for this category of imports (Brazilian airlines at present import aircraft at the rate of Cr$ 45 per dollar, which is only just over half its true value, but may shortly have to pay Cr$ 85 per dollar) it now looks as if VARIG will have to concentrate its financial efforts on the North American route, where competition is greater, and not take up its option on these Viscounts.

Five 810 series Viscounts are, however, now being bought by VASP (Viaçao Aérea Sao Paulo), a slightly smaller airline with no international services with which VARIG has entered a kind of pool arrangement, though not a merger. According to this, routes of both companies (VASP, based in Sao Paulo, covers that state and the central hinterland) will be operated by the most suitable aircraft of either company. These VASP Viscounts will thus fill the gap over some of VARIG's trunk routes until that company is ready for the next stage for which, most probably, the Caravelle will be chosen, over-riding an earlier interest in the Electra. The Caravelle made a very successful visit to the VARIG headquarters on its recent South American tour, and the company is now reported to be sending technicians to Toulouse to study equipment.

At present, the runway at Santos Dumont, Rio's city airport for domestic routes, can only cope with DC-3s, Scandias and C-46s; and it is so conveniently situated where the business heart of the city edges on the bay that services operating with larger aircraft, particularly on the short Sao Paulo route, from Galeao International Airport some ten miles away, are at a disadvantage. It is, however, being lengthened on further reclaimed land to meet the requirements of the immediate future. (The President's Viscount, coming in for a check-up, effected a perfect landing at the airfield in its present state, to many people's surprise.)

Jets are not only favoured by the management for domestic medium-haul routes but even more so for the New York route and for possible new lines to Europe and the Far East. VARIG is now strongly rumoured to be ordering three Boeing 707s—possibly with Rolls-Royce Conway engines—for delivery in late 1959, with which it is hoped to make Rio - New York non-stop an economic proposition.* There is a large and very wealthy *clientèle* on that route, and VARIG is doing all it can to assume a leading position on it. To take care of traffic demands until then, it has ordered two or three more Super-G Constellations (in place of the L.1649As originally selected) while North American carriers are operating with DC-7s, as is Panair on its service to Europe. VARIG is thus not particularly interested in long-range turboprops, which it feels it could use only as an interim measure. It is perhaps for Class-B long-distance international services run by other Brazilian airlines—and at present operated with Skymasters—that the long-haul turboprops may be considered.

** Since this was written the company have signed a contract for three Boeing 707s. No final decision on engine-type has been made ("Flight", September 20).—Ed.*

CALLSIGN JET SPEEDBIRD (continued from page 535)

are the excellent E. K. Cole Search Radar E.120 (the map-painting facility of which is said to be "proving first-class"); the Marconi AD.712 crystal-controlled ADF; the Decca Navigator Mk 8 at high altitudes and high speeds; and the Standard STR-30 B low-range radio altimeter, which is being used for evaluation and low-level checks on the lag and hysterisis errors of the pressure altimeters. In spite of contour effect, the radio altimeter may prove very useful for operation in really low limits, and in this connection the aircraft is equipped with cockpit-coaming-mounted lights to give visual indication of critical and flare-out height.

Long range *en route* navigation still poses many problems (on this series of flights, V.H.F. and H.F. R/T. with its 300 miles plus high-altitude range is being used), but D.I.A.N.—the Decca/Dectra/Doppler combined equipment—is thought to be a promising aid which would give the needed discrete track facility for the climb-out and *en route* phases. The Decca facility would be used for high-altitude stacking in conditions of strong and varying winds.

Although these Comets are not truly representative of the 4s, it is obviously possible to re-appraise the operating techniques that were adopted during the 25,000 hours of operations with the Comet 1. It was found then that flight planning should be done "backwards"—from the weight overhead at the destination with empty tanks, plus reserves (stand-offs, diversions, *en route* performance and navigation deviations) to the weight at take-off. Forward planning, working on the payload and fuel needed, tends to produce economic penalties. For an additional 1,000 kg of fuel, 28 per cent will be burnt "just for the pleasure of carrying it"; if planning is done for a weight greater than the actual take off weight the aircraft will be operated at too low an altitude and more fuel will be used. In spite of this condemnation, the 2Es are operating on a forward-planning technique, because every type of operation is being studied and full tanks out from Beirut is the rule.

Experiments with cruise climb, stepped climb and constant-altitude cruise techniques (where increased consumption is offset against superior T.A.S.) are being made. Looking ahead, a "drift-up" cruise climb along a discrete track and with lateral separation appears to be a better proposition for jet operations than the theoretically equally good stepped climb, since vertical separation as at present employed by A.T.C. may militate against the required height steps being made at the right time—or to the right altitude.

Flight operation on the Beirut and Bilbao runs follows normal Comet practice: 2,000ft before the estimated stabilizing altitude is reached, the temperature deviation and aircraft weight is determined, the chart consulted and the correct altitude for starting the cruise is found. This is usually somewhere between 32,000 and 34,000ft. To operate the two RA.29s in a representative manner, they are throttled to the cruising r.p.m. that will be used on the Comet 4 and the r.p.m. of the inners are then adjusted to give an indicated Mach number of 0.73 (0.74 corrected). This represents an r.p.m. difference of about 100, with the outers running slightly slower.

It is early yet to judge how the operation is going. So far so good; and there is the ebullient enthusiasm from all concerned that makes molehills out of other people's mountains. A hint of the filter-icing trouble that has been found in R.A.F. Transport Command operations has led to a study of the penalties involved in using filter heat and the effect of unfrozen water in solution being released downstream of the filter. But this is routine development which has been under way for some time, as is fuel water-content analysis, carried out religiously at every refuelling with the Shell water-content detector. Answers are also being sought to the effects (on water content) of adding warm to cold fuel, and the possibility that the tank vents are responsible for condensation within the integral tanks.

One problem there is that is yet unsolved: the cooling blowers for the radio equipment are noisy—just the same annoying fault that troubles Rolls-Royce car owners when their clocks tick too loudly.

ATOMICHRON WITH NAVARHO

THE U.S.A.F. has incorporated the cesium atomic frequency standard called Atomichron (made by the National Company, Inc., Malden, Mass) in the experimental transmitter for the Navarho long-range navigation system. The installation was made on September 5 last year and good results are reported. A frequency standard of the extreme accuracy provided by Atomichron is necessary in order to achieve the 1 per cent accuracy in the distance-measuring element of Navarho. A distance measurement is obtained by phase comparison of two synchronized frequencies, one on the ground and the other in the aircraft. Data is displayed on indicators in the aircraft cockpit.

Atomichron works by monitoring a frequency-producing system to the resonance of the cesium atom and can produce usable signals at 100 kc/s and at 1, 5, 10 and 100 Mc/s with a stability of five parts in 10^{10}. (Additional details of the working of Atomichron appeared in *Flight* for April 12.)

A further advantage claimed for Atomichron is that, in the high-frequency spectrum, it will permit the use of radio receivers and transmitting equipment with unprecedented narrow bandwidths and precise frequency control. By limiting the spread of radio signals in this way a much greater number of channels can be used in a given frequency band. Present Atomichron equipment measures 84in high by 22in by 18in, and weighs 500 lb. The National Co. estimated some time ago that they could produce an airborne version weighing 60 lb.

Beside the Bamboo Curtain

No. 28 Squadron at the End of the Far East "Pipeline"

BASED on the southern shore of Communist China, nearly 400 miles from Formosa and 1,400 from Singapore, Air Headquarters Hong Kong is the most easterly situated R.A.F. formation. Comparable in size with a Group, it was established after the last war. It is subordinate to F.E.A.F. Headquarters in Singapore for matters of SEATO policy and its present A.O.C. is A. Cdre. A. D. Messenger. It has the distinctive postal address B.A.P.O. No. 1, and claims to have the longest line of communication in the R.A.F. between a subordinate and commanding formation.

A.H.Q. has its offices in the combined headquarters building —which houses H.Q. British Forces Hong Kong and R.N. and Land Forces' as well as R.A.F. staff—in Victoria Barracks on Hong Kong Island. Co-operation between the three Services is said to be "enjoyed to an extent perhaps unobtainable elsewhere." There is also an excellent relationship between civil and military populations on the island.

Air Headquarters controls Kai Tak, Sek Kong and Shatin airfields on the mainland, plus Signals, Police, Movements and other units. All three airfields are surrounded by mountains, a natural hazard that is soon accepted by pilots in this area. However, these obstructions make for some of the most difficult approaches to be encountered in Service flying and a high standard of airmanship is required at all times, particularly as katabatic and anabatic winds have more than an academic meaning at Hong Kong. Sek Kong has been relegated to the rôle of an emergency field as a result of the White Paper on defence, involving the move of No. 28 Squadron to Kai Tak. Kai Tak is a joint user airfield, which apart from its numerous civil activities houses a Station Flight, No. 28 Sqn., a squadron of the R.A.F. Regt. (Malaya), the Hong Kong Auxiliary Air Force and a Marine Craft Section and flying-boat base—all under normal R.A.F. station control. During the march of Communism through China, two fighter squadrons—Nos. 28 and 80—were stationed in Hong Kong. No. 80 was disbanded in April 1955 but No. 28 is still operating in a day fighter/ground attack rôle and its work is described later in this article.

R.A.F. Shatin (now only a temporary designation) is the home of the A.O.P. flight operating Austers. It is the proud possessor of a concrete strip, perhaps one of the most elegant Auster operating grounds in the field. However, the A.O.P. flight's long association with A.H.Q. Hong Kong will shortly be severed, when the newly constituted Army Air Corps takes over complete control of all Army flying units.

Apart from the aircraft staging through Hong Kong, various types have seen service there, namely Sunderlands, Austers, Harvards, Hornets, Mosquitoes, Vampires, Venoms, Meteors, target-towing Beaufighters and versatile Valettas. Unfortunately, these aircraft all seem to spend their last days in the service there, as No. 28 Squadron well know.

Four Venoms of No. 28 Sqn. in echelon above Kai Tak, its present base. Part of the new runway which is at present under construction can just be seen in the right foreground.

No. 28 Squadron's own position and experiences at Hong Kong are recounted in the following first-hand notes by a member of the unit who is at present serving there and clearly finds conditions active and congenial.

In recognition (he writes) of the fact that it had almost 40 years' unbroken service, No. 28 Squadron was presented with a standard in March 1955. The honour of presenting this standard was given to a former member of the squadron, Air Marshal Sir Francis Fressanges (then Commander-in-Chief, Far East Air Forces), who had served with No. 28 in the early 1920s during north-west frontier operations.

Since 1920, the squadron has served continuously overseas, in

A Dakota of Hong Kong Airways airborne from Kai Tak; and right, the pilot's view when on "long finals" at Sek Kong, where No. 28 Sqn. was based until it moved to Kai Tak in June this year.

BESIDE THE BAMBOO CURTAIN . . .

A squadron group taken in September last year during the visit of G/C. D. Bader, to the left of whom is G/C. A. J. M. Smyth, station commander at Koi Tak, and to the right S/L. A. Phillips, the present O.C. No. 28 Sqn.

India, Burma and Malaya, and in 1949 moved to its present location in Hong Kong, being now equipped with Venom 1s. It had the somewhat dubious honour of being the last operational squadron to be equipped with Spitfires and then with the Vampires, and it may yet do the hat-trick with Venoms.

In Hong Kong, the Squadron was first based at Kai Tak, but in 1950 moved to its "up-country retreat," Sek Kong. This airfield, situated amongst the mountains of the New Territories and some 20 miles from the "bright lights" of Kowloon, must be one of the nearest R.A.F. airfields to Communist territory as the end of its runway is a mere six miles from the border.

Former members of the squadron must have nostalgic memories of the rather primitive conditions which greeted them on arrival at Sek Kong, when the pilots' crewroom consisted of a large packing-case, desert-lilies and thunder-boxes grew in profusion and all accommodation was of the Nissen-hut variety. The squadron commander was also unit commander. Despite primitive living and operating conditions, a tour of Sek Kong must rank with the best available in this peace-time Air Force, and morale has always been of the highest order.

Sek Kong airfield consists of a single strip runway, barely 2,000yd long and hemmed-in on three sides by towering hills. Take-offs can only be made in one direction and landings must be made in the reverse direction. Consequently, a little extra "finger out" is necessary in circuit procedures, since coupled with the lack of any undershoot or overshoot areas, domestic accommodation of various Army units has encroached to within 12 yards of the runway at some points, and the prospect of a burst tyre on landing or take-off was something that doesn't bear thinking about. A built-in cross-wind forms an additional hazard, and the close proximity of the hills must make Sek Kong one of the trickiest airfields in the world.

Recovery and bad weather let-down procedures are unique, to say the least, and Sek Kong must possess the original "poor man's G.C.A."—Zippy, an item of equipment which has proved invaluable. It consists of a mobile radar unit, normally used by the Army for ack-ack fire control, and giving excellent radar coverage up to 25-30 miles from the airfield. It was rescued by a former squadron commander from an Army salvage dump and has given sterling service ever since. The addition of C.R.D.F. and A.C.R.7 approach aids in recent years has eased the burden of the controllers a great deal, but "Zippy" is still considered to be the most valuable piece of equipment. It has also proved to be an excellent met. observer, as rain showers and heavy cloud can be accurately plotted up to a range of 25-30 miles. Once again, this has proved invaluable, since apart from Kai Tak, the nearest diversion airfield is in the Philippines—some 600 miles away, with an awful lot of "oggin" in between.

The squadron's rôle is DF/GA, and with the excellent facilities available at Port Shelter Range, the standard of weapons results is well above average. Air-to-air firing is restricted to low and medium levels owing to the proximity of civilian airways.

Flying generally in Hong Kong, though somewhat restricted in area, can be very pleasant and interesting. The natural beauty of the Colony must be among the finest in the world, and daily "armed-recces" flown by the duty pair have the object of keeping an eye open for pirate junks and unusual activity in the Pearl Estuary. During the summer months, spotting sharks and manta rays around the more popular beaches is added to the pilots' authorization. The problem of "getting one's feet wet" (overflying the border) naturally arises, but cases are few and far between; and to date, no record of any "red stars" appearing over Hong Kong can be found.

Recently, two squadron aircraft collided in mid-air at 30,000ft, some 40 miles out to sea. The two pilots ejected safely and subsequently received a ducking. One was picked up within minutes of entering the water, and the other about half an hour afterwards, both by the same Chinese fishing junk. Some weeks later, at a colourful ceremony held in a local fish market, the A.O.C. presented the crew of the junk with a scroll recording the rescue, an enormous sack of rice, and the sum of $1,000.

During 1956, the squadron parted with its well-tried Vampires and re-equipped with Venom 1s. This entailed ferrying the Vampires down to Singapore, picking up the Venoms, and returning by the same route. Four aircraft at a time were ferried, thus enabling the squadron to continue training while re-equipping. The route taken for the ferry was *via* Clark Field in the Philippines, Labuan in North Borneo, Kuching in Sarawak, and thence to Singapore, a trip of some 2,000 miles. Long-range tanks were only fitted on the last four aircraft brought up, and several hair-raising experiences were encountered during the first few ferries; but it is worthy of note that not one aircraft was left behind at any of the staging-posts throughout the ferry period.

Showing-the-flag trips to Manila and Clark Field are a feature of interest, and at a recent display the squadron aerobatic team put up an extremely good show, stealing the honours from teams from the U.S.A.F. and the Philippine and Chinese Nationalist Air Forces, and being presented with a flowery citation for a "distinguished and outstanding contribution to aviation in the Philippines." A Battle of Britain flying display is held annually at Kai Tak, and the attendance is tremendous. The squadron has to bear the brunt of the flying and for the past three years boasts of having had all sixteen aircraft in the air for the final fly-past.

Entertainment in Hong Kong knows no bounds. It is a shoppers' paradise, a gourmets' delight, and has a night life second to none. Sport of all descriptions is available, from horse-racing at the beautiful Happy Valley racecourse to soccer and rugby in the magnificent stadiums, skin diving and underwater spear-fishing along the beautiful coast, and Service clubs to cater for all tastes. Social life in Hong Kong can be quite strenuous, and the generosity of local inhabitants makes after-duty hours most pleasant.

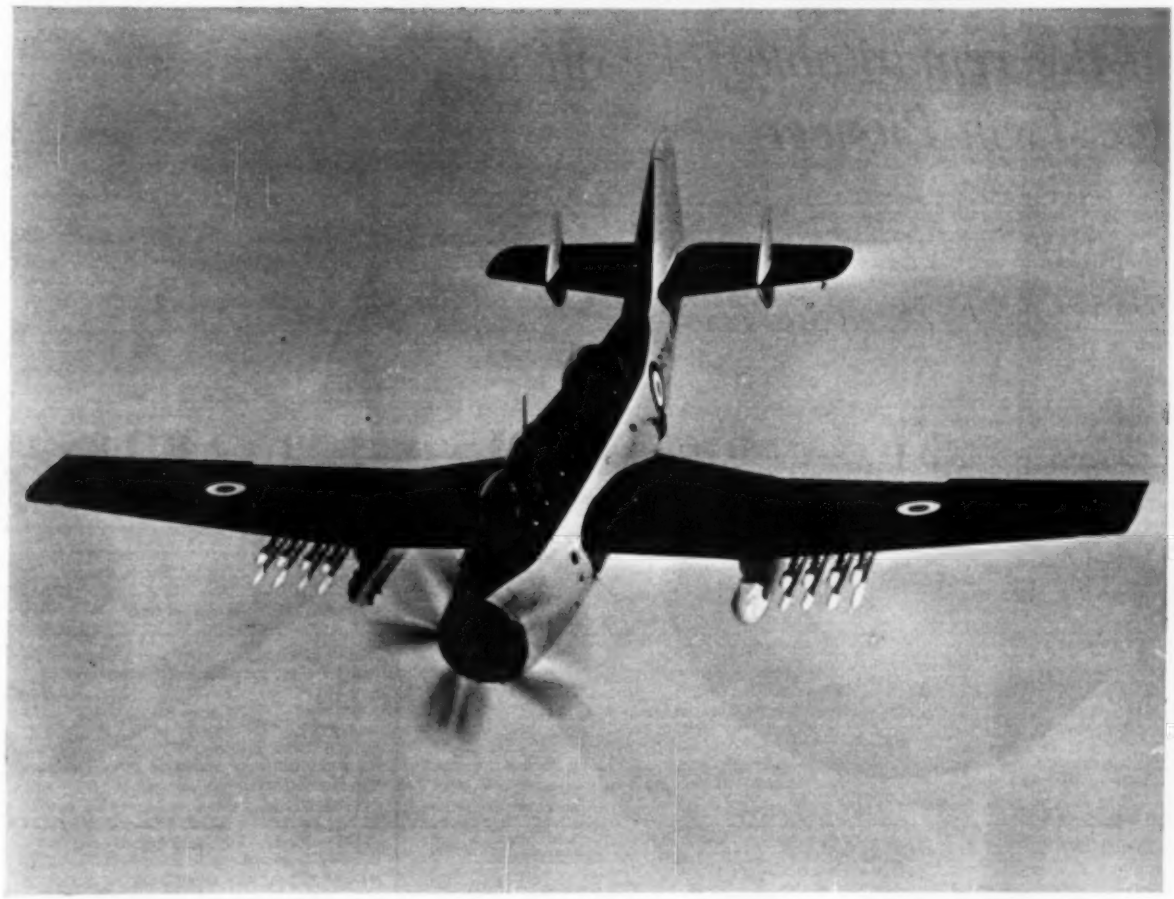
A recent acquisition by squadron pilots is a 35ft Chinese junk, aptly named *The Flying Horse* (which appears on the squadron crest). Sailing this fiendish Oriental craft proved to be no easy matter, and after a few sorties the Junk Admiral decreed that a system of Green and Master Green tickets be introduced. There is still a vacancy for a qualified Junk I.R.E. with no engine experience.

In June this year, the squadron bid farewell to Sek Kong, and moved to Kai Tak, as part of the Far East economy cuts. This move was not a popular one among squadron personnel, despite the fact that the bright lights and attractions of the city are now literally on their doorstep. The future of the squadron now hangs in the balance, but it is hoped that a decision is made to allow it to remain where it is, at the "end of the pipeline."

The future of the R.A.F.'s lone outpost at Hong Kong is unknown, and the effects of the defence cuts (apart from the closing of Sek Kong) remain to be seen. All the personnel who are fortunate enough to be posted to Hong Kong are unanimous in hoping that no significant changes will be made. There seems little doubt that there will be R.A.F. representation at this historic Colony, on the fringe of the Bamboo Curtain, for a long while to come.

Below, recreational facilities at Hong Kong include No. 28 Squadron's private junk, "The Flying Horse," and refreshments indicated by an inn-sign near Station H.Q. which bears the same motif.

FAIREY GANNET



The Fairey Gannet has proved in service to be the world's most successful anti-submarine aircraft, combining the ability to search and to strike with the most formidable modern weapons. Powered by the Armstrong Siddeley Double Mamba, it has twin engine reliability. These aircraft are in service with the Royal Navy and the Royal Australian Navy and are on order for Western Germany's Naval Air Arm.

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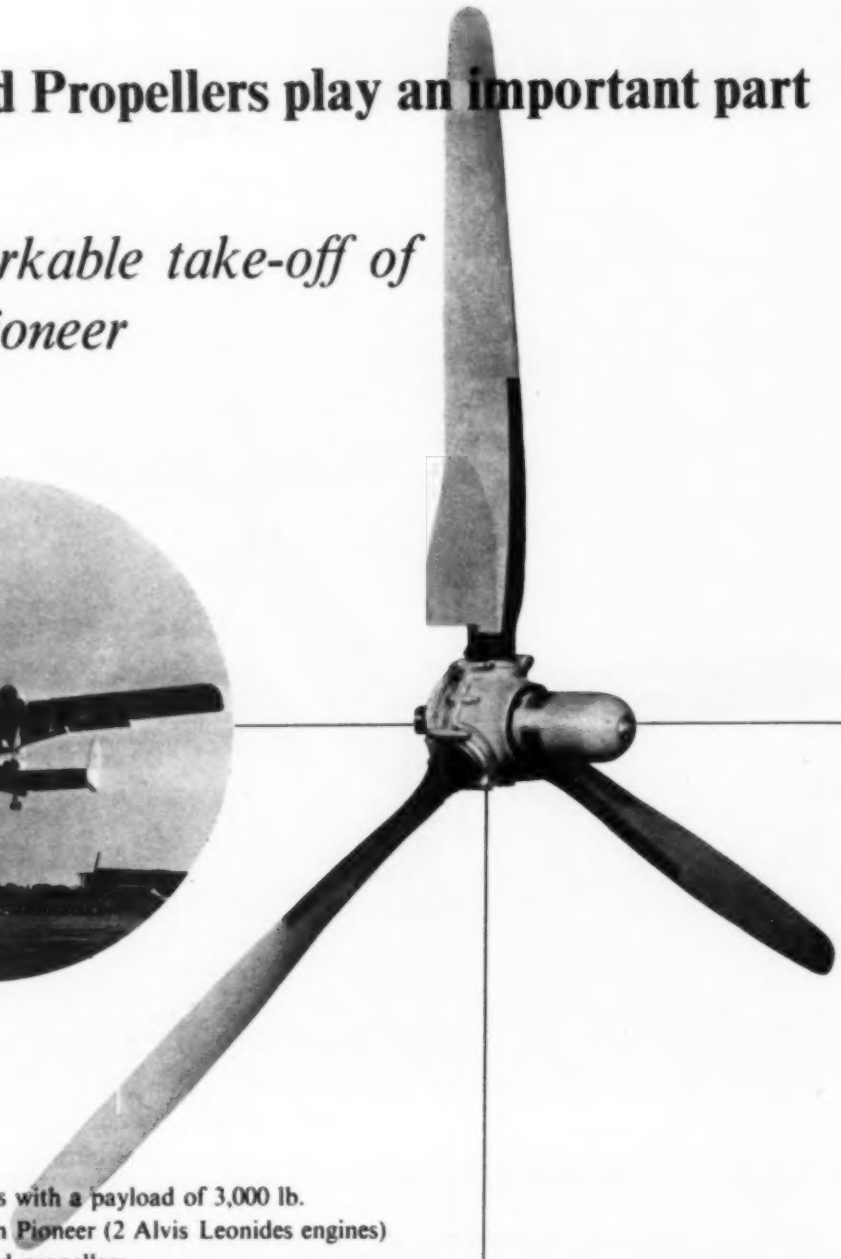
de Havilland Propellers play an important part

in the remarkable take-off of the Twin Pioneer



For a take-off in 104 yards with a payload of 3,000 lb.
the Scottish Aviation Twin Pioneer (2 Alvis Leonides engines)
depends upon de Havilland propellers.
They were especially designed to provide this performance.

HEAD OFFICE
HATFIELD, HERTFORDSHIRE

Southern Factories
Hatfield, Stevenage, Edmonton

Design Offices
Hatfield and London

DE HAVILLAND PROPELLERS LIMITED

Northern Factories
Lostock, Farnworth, Walkden

Design Office
Manchester

The Martin Mariner amphibian of the Royal Netherlands Navy, seen on the left, was an impressive visitor to Blackbushe during Farnborough week. The second amphibian is the Grumman SA-16A Albatross, which was an equally impressive visitor to the Royal Aeronautical Society Garden Party at Wisley on September 15.

AIRCRAFT INTELLIGENCE

U.S.A.

Century-series Fighters. Arrester hooks of naval pattern are to be adopted for the McDonnell F-101 Voodoo, Convair F-102 Delta Dagger, and Lockheed F-104 Starfighter of the U.S.A.F's Air Defense Command.

McDonnell Production. According to Mr. J. S. McDonnell, president of the McDonnell Aircraft Corp., neither the F-101 nor RF-101A or C, nor the F4H-1, have been "stretched out or terminated" in production. The F3H Demon and F-101B programmes have, however, been "stretched." The U.S. Navy has ordered Demon deliveries to be reduced from 12 a month to 10 a month until February 1958, and to 11 a month beginning in March 1958. U.S.A.F. deliveries of the two-seat F-101B are being reduced from 30 a month to 20 a month, and the last delivery date for 101s on order will now be August 1959 instead of March of that year. The F-101C mentioned by Mr. McDonnell has a strengthened airframe for low-level fighter/bomber work.

Douglas C-133. A number of modifications have been incorporated in this very large U.S.A.F. transport. The fairing at the junction of the wing and fuselage has now been considerably extended and is as long as the undercarriage housings. A tail cone has been fitted and there are vortex generators on the wings outboard of the engines.

Hiller Helicopter Sales. Recent deliveries of Hiller 12-C three-seat helicopters have been made to five countries—Panama, Ecuador, Argentina, New Zealand and Canada. A Hiller announcement reads: "Panamanian banana growers report effective and economical control of leaf-spot through the use of two Hiller spray-gear equipped 12-Cs. These machines, newly purchased by Fison-Airwork, Ltd., Cambridge, England, one of the world's largest operators of agricultural aircraft, are the latest addition to the company's Hiller fleet." The 12-C for Ecuador is a de luxe agricultural/transport version.

Italy

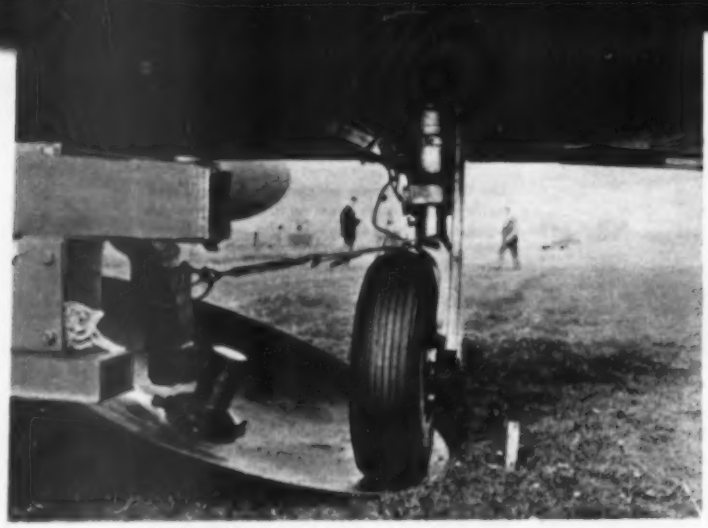
Fiat G-91 and G-91T. Three prototypes of the G-91 tactical fighter are now flying (the first prototype, which was destroyed, has been replaced) and development of the G-91T two-seat transonic trainer is under way. With a Bristol Orpheus BOr.4 turbojet, of 4,500 lb thrust, this 11,000 lb trainer will have a maximum level speed of about 650 m.p.h. (the max. design Mach number is 1.17) and an endurance of 1 hr 40 min. This aircraft will be competitive with the Folland Gnat Trainer in world markets.

Netherlands

Fokker Activities. Fokker report that during 1956 they delivered 57 licence-built Hawker Hunters to the Royal Netherlands Air Force. Seven Hunters were made for Belgium. Under Bristol licence 1,200 drop tanks were built, and an order for 1,520 additional tanks was received from Belgium. More than twelve airline operators are now negotiating for Friendships, to a total of about 50.

SAUNDERS ROE SR.53
(D.H. Spectre and A.S. Viper)

Span	25ft 1in
Length	45ft



An aircraft mainwheel in position on one of the "skid-wheels" of the experimental model. The diagram below shows the general arrangement.

Ground-handling Aircraft

A New Method

By E. R. STABLES*

THE problem of ground-handling aircraft equipped with high-pressure tyres has suggested a new method of transport over soft ground, and the system is now in process of development.

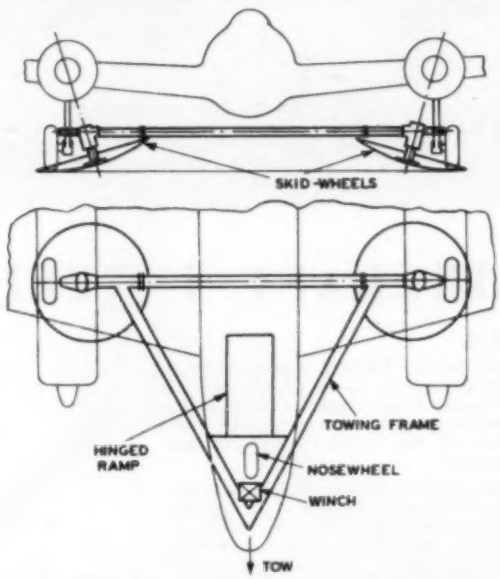
Various multi-wheeled or endless-track aircraft transporters have been investigated from time to time and an experiment was conducted at R.A.E. Farnborough a few years ago in which a Meteor was hauled over soft ground on plain skid pans. But these methods were not entirely satisfactory. The wheeled or endless-track transporters proved cumbersome and expensive, and the plain skid-pan scheme required an excessive tractive effort.

A combination of wheel and skid was then tried, in the form of a rotating skid or "skid-wheel." By this method the aircraft is rolled into two saucer-shaped pans which bear on the ground well to one side of their centres and rotate freely about slightly inclined axes. The pans are arranged to tilt backwards as the aircraft is winched into them. When in position the aircraft is located longitudinally and transversely relative to the triangular frame which carries the skid wheels, and the aircraft wheels are left free to rotate. The nosewheel is drawn up a ramp on to a platform at the apex of the frame and the frame is towed by the tractor.

The drawbar pull required by such an arrangement has proved to be much less than that required by fixed skids, this by reason of the lower relative velocities that occur between the surface of the skid-wheel and the ground. It has been shown that the instantaneous centre of rotation of the skid-wheel remains close to the centre of the ground contact area. Points on the skid-wheel surface rotate about the instantaneous centre with velocities proportional to their distances from it, and these velocities are considerably less than the speed of tow. A theoretical estimate indicated that the drawbar pull might be about one-third to one-quarter of that required with fixed skids, for a transporter suitable for an aircraft weighing about seven tons, giving a ground loading of about 25 lb/sq in.

A full-scale experimental model transporter was made and tested and the practical results confirmed the theoretical estimates. The transporter performed very satisfactorily, manœuvring easily and giving a smooth ride. A prototype suitable for the Hunter aircraft is now being constructed by Rubery Owen and Co., Ltd., to a Ministry of Supply specification.

Design studies are being made into the possibility of utilizing the skid-wheel, with or without an internal running wheel, as a carrier for other forms of vehicle for use on soft ground.



The main details of the experimental model and a summary of the results are given below:—

Total load applied to the ground through two skid-wheels	4 to 8 tons (approx.)
Rim diameter of skid-wheels	66in
Thickness	0.375in
Spherical radius	72in
Angle of inclination of axles	18½ deg
Width of tracks made on the ground	14in (4 tons) to 23in (8 tons)
Ground loading (at all imposed loads)	25 lb/sq in approx.
Aircraft tyre pressure	120-130 lb/sq in approx.
Depth of sinkage	0.4in to 0.9in
Distance from centre of skid-wheel to centre of contact area	22in (mean)
Distance from centre of skid-wheel to instantaneous centre	25½in (mean)
Drawbar pull (skid-wheels rotating)	200-600 lb/ton
Drawbar pull (skid-wheels locked)	300-2,000 lb/ton

**The author is Assistant Director, Directorate of Aircraft Mechanical Engineering, Ministry of Supply. A full description and theoretical analysis of the skid-wheel method appeared in the April 19, 1957, issue of "Engineering."*

ELECTRONIC AID TO PHOTOGRAPHIC SURVEY

CONVENTIONAL methods of photoprinting air-survey negatives are ordinarily responsible for one of the main limitations of such work, detail being lost in cloud shadows and a further difficulty arising in the matching of prints from adjacent flight-lines flown on different occasions or in varying conditions. A certain amount can be done by the printer "dodging," but this subterfuge quickly becomes impossible if large numbers or small details are involved.

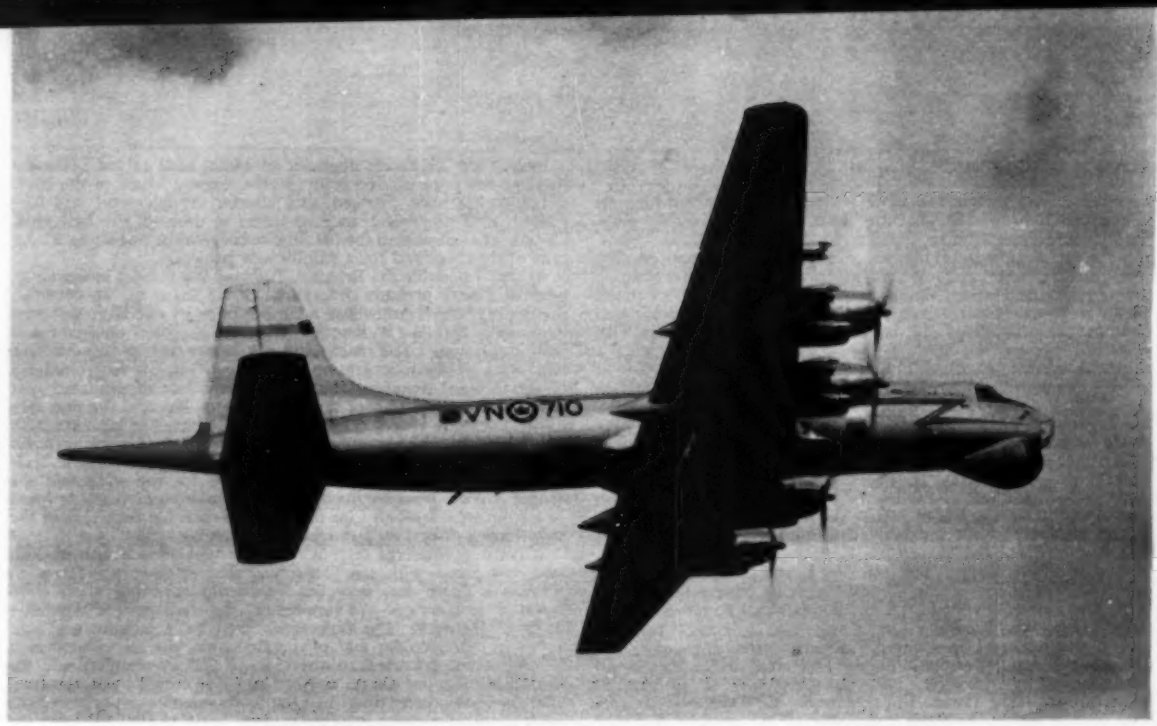
All this, and more, is automatically looked after by the new E.M.I. LogEtronic photoprinter, which employs a cathode-ray tube as the light source. In a manner similar to that familiar in television, except that it follows a rectangular rather than horizontal path, a small spot of light scans a selected area of the tube and by optical projection scans the negative and makes the exposure on the printing paper.

Diffused light penetrating the paper falls on two photocells. The first of these views the entire field and modulates the intensity of the spot by means of a suitable feedback amplifier. Thus the light falling on the negative is controlled by its own local density at that point and automatic "shading" of the print is achieved.

The second photocell and its associated circuits have two functions. They automatically control the exposure time and switch off the system when the optimum exposure has been given. Also, this photocell can be made to view either the complete printing area or a selected portion of it.

In short, the LogEtronic system effectively reduces the overall contrast range of the negative to suit the printing medium, and can thus be made to bring out considerably greater detail in the picture.

Once the controls on the printer have been set to suit the user's processing technique and the chosen paper or film, the shading and the exposure are automatically controlled for all ensuing negatives. E.M.I. Electronics, Ltd. (Hayes, Mddx.), have several variants of the new equipment under development.



CANADAIR ARGUS

The Far-ranging Patroller of the R.C.A.F.

By THE TECHNICAL EDITOR

LAST Monday the first Canadair Argus to join the Royal Canadian Air Force was formally handed over at a ceremony at Montreal. Receipt of this fine aircraft gives the R.C.A.F. the most versatile and most capable long-range maritime patrol machine in the world. Built in Canada, it has an airframe based upon that of the Bristol Britannia and employs American powerplants.

The number of successful military combat aircraft which have been evolved from commercial transport designs is exceedingly small (a classic example, of course, is that of the original Lockheed Hudson, for purposes similar to those of the Argus), and the reasons behind Canada's adoption of this hybrid machine are worth recounting. It was in 1952 that the R.C.A.F. issued a requirement for a maritime patrol aeroplane, to replace the ageing Lancasters of Maritime Command and operate alongside the newer Neptunes on missions beyond the capabilities of the latter aircraft.

After agreeing upon the necessity for such a machine, the R.C.A.F. undertook an investigation into existing aircraft which were potentially suitable. The result was negative, and it was concluded that two approaches to the problem were possible: a completely new aircraft could be designed to meet the R.C.A.F. specification or a suitable aeroplane could be evolved from the Bristol Britannia 100. The latter aircraft seemed the most promising basis on which to build, for reasons which included its recent conception, aerodynamic efficiency, low percentage structure weight and manual control system. Canadair, Ltd., of Montreal, a Division of General Dynamics Corporation, were assigned the task of preparing design studies and cost analyses for both alternatives.

Eventually the choice fell upon the adoption of the Britannia, whereupon the Canadian government concluded a licence-agreement with Bristol and appointed Canadair as its agent to "procure the necessary engineering information from Bristol, adapt the Britannia basic design to the specific military requirement, tool, manufacture and develop the maritime patrol aircraft."*

Final instructions to proceed with the programme were given to Canadair in April 1954. The company's Engineering Division has since borne a heavy load in undertaking the complete redesign of the British aeroplane and in developing all the necessary systems, tooling and manufacturing processes as well as carrying out exhaustive test and research programmes. Canadair designated the new aircraft the CL-28, and it bears the R.C.A.F. designation CP-107; its appropriate name, Argus, is that of a giant in Greek mythology endowed with a hundred eyes.

**The quotation is from a paper by William K. Ebel, vice-president, engineering, and Everett B. Schaefer, chief engineer, aircraft, of Canadair, Ltd.*

One of the most fundamental reasons for differences between the Argus and its British progenitor lies in the nature of its operational mission. The airliner is built to cruise at high speed and high altitude, and turboprops can perform this function with extreme economy and passenger-appeal. In contrast, the Argus is rarely required to fly particularly fast nor at heights greater than a few thousand feet, and it spends much of its operational time in relatively close proximity to the surface of the sea. In these conditions the turboprop shows up poorly in comparison with the most efficient piston engine; and, by the same token, fuselage pressurization is no longer required.

Dealing with the powerplant aspect first, it was evident from the outset that, for the best mission performance, the Proteus gas-turbine powerplants of the Britannia would have to be replaced by piston engines. The obvious choice was the Wright Turbo-Compound, which was installationally suitable, gave adequate power and was already in R.C.A.F. service, with the Neptune. The diameter of the Turbo-Compound is not much greater than that of the Proteus, but the firewall has been redesigned and is at a different station from that of the Britannia. Forward of the firewall everything is new, and the overall powerplant also differs slightly from previous Turbo-Compound installations. The engines themselves are of the 981TC18 EA-1 type, very similar to those used in the DC-7C. Petal-type cowlings are used, as shown in the large drawing. The oil cooler is mounted in a duct on the underside of the powerplant, and the downdraught injection carburettor is fed from a ram intake on top.

For the first time in a Canadian aeroplane, considerable use has been made of titanium, which forms virtually the entire bulkhead and skin structure in the firewall sections at the forward end of each nacelle (the external skin appears darker than the light-alloy areas, as the illustrations show). More than 2,700 lb of titanium is employed, and the weight-saving is approximately 900 lb compared with the minimum which could be achieved with aluminium alloy and stainless steel. Owing to the absence of jet-pipes the upper line of the nacelles is different from that of the Britannia. The oil tanks, together with certain accessory items, are housed in the upper forward parts of the nacelles.

Each engine drives a feathering and reversing Curtiss electrically controlled three-blade propeller, with the surprisingly small diameter of 15ft 6in. Long before the first aircraft was completed, Canadair constructed a powerplant test rig which has now logged well over 600 hr of ground running. It proved its worth in bringing to light shortcomings which would otherwise have been built into the first aircraft; it was also employed in a determination of noise-measurement, in which a portion of fuselage was located alongside with the correct propeller-tip clearance.

An incidental advantage of the elimination of jet pipes is that

CANADAIR ARGUS...

the bogie beams of the main undercarriage units do not have to lie completely horizontal when the units are in the retracted position. Instead, the relative angular movement between the beam and the leg during the retraction cycle is no more than 60 deg, and Canadair were thereby able to dispense with the hydraulic pivoting of the British Messier undercarriage of the Britannia, substituting mechanical actuation. At one stroke this eliminated a number of jacks, pipes and sequence valves, replacing them with a simple linkage attached to the upper scissors-link, with a resultant weight-reduction of 12 lb on each main-gear unit.

In other respects, however, the main undercarriage is substantially similar to that of the Britannia. The total of eight mainwheel tyres, each 36×11in, allow the Argus to operate from I.C.A.O. Class 4 runways. Subcontractors to Canadair for the complete main undercarriage unit are Jarry Hydraulics, who last month opened a new 18,000 sq ft shop equipped with heavy machine tools specially suited to the big Argus gear.

A major change, dictated by the possibility of combat damage, is the addition of a completely distinct system for emergency brake operation. In the Britannia, dual-piston braking is controlled by a four-way valve operated by conventional linkages from the pilots' pedals. For the Argus, Canadair have separated the main and emergency feed-lines and control valves, the emergency system being energized by a special switch on the cockpit pedestal. Eight braking operations can be obtained from the emergency accumulator, and the system is also energized by an electrically driven stand-by hydraulic pump described later. It is intended to fit an anti-skid system (the Britannia has Dunlop Maxaret), but such a feature was not called for in the original R.C.A.F. specification.

Also made by Jarry to Canadair design, the nose undercarriage differs from that of the Britannia in that it retracts in a rearwards direction. This change was necessary in order to permit an optimum installation under the nose for the search radar, the fairing for which is provided with a large recess to accommodate the nose leg in the extended position. As the gear retracts to the rear, under the pull of a hydraulic jack by the Fairey Aviation Company of Canada, two sets of doors are simultaneously operated to seal off the compartment into which the unit retracts. The lower doors, which remain open when the gear is down, are mechanically linked to an upper pair which are stressed to resist the maximum calculated water impact loads which could occur during ditching. The nose tyres are 29×7.7in and the wheels are steered by a system operating at 3,000 lb/sq in. The latter is 1,000 lb/sq in greater than that employed in the Britannia (in which a reducing-valve is fitted to halve the main supply pressure), and the reduced diameter of the steering cylinder has permitted a weight-saving of 9.6 lb.

Superficial inspection of the Argus and Britannia shows at once that the two aircraft differ considerably in their fuselage design. Throughout the entire airframe, however, engineering changes have resulted from the conversion from British to American material standards, the dictates of military requirements and the suitability of the British airframe to Canadair's manufacturing ability. From the outset a stringent programme of weight control was applied and in certain items efforts were even made to save fractions of an ounce. At the same time a ruling dictum on the Argus structure was "strength equal to, or greater than, that of the Bristol airframe." As a commercial transport the Britannia is designed to a limiting load-factor of 2.5; the Argus, however, is designed to a factor of 3, and it is conceivable that relaxation of this factor will permit a substantial increase in gross weight, thus conferring upon the Canadian aircraft an unusual growth potential.

This one-fifth-scale model, of wood covered with copper mesh, was built in order to assess radio performance, particularly in relation to the isolated fin aerial. The Argus has no fewer than 41 aerials.

Except for the ruling diameter of 144in, little of the Britannia fuselage has been carried across to the Argus. Much of the basic structure has been changed, and interior arrangements and furnishing bear no resemblance whatever to those of the Britannia. Canadair have assessed the fuselage redesign as representing 95 per cent of that required for a wholly new project.

As far as possible the Britannia fuselage is a perfect monocoque, bearing a peak pressure differential of 8.3 lb/sq in. In contrast, the unpressurized Argus hull is broken open by two large weapons bays, each 18ft 6in in length, which are disposed ahead of and behind the wing. The main wing-box passes through the fuselage with a longitudinal separation of 20in between the rear bulkhead of the forward weapons bay and the front face of the front spar and the front bulkhead of the rear weapons bay and the rear face of the rear spar. Heavy channel sections, extruded in high-strength light alloy, form the boundary members for the weapons bays and carry structural loads through the cut-out portions. These keel-like members carry the mounting points for the wing and the hinges for the weapons-bay doors, the balance of fuselage loads being diffused through four torsion cells (one for each side of the two weapons bays) each roughly of triangular form.

A constant fuselage section is maintained for a length of 48ft, and, compared with the Britannia, the windows are fewer in number. There are, however, numerous scanning windows—some of them bulged—to supplement the visual-search capability of the flight deck. The flight deck itself has a window and roof structure quite unlike that of the Britannia, the transparent area having been extended to meet an R.C.A.F. requirement for increased visibility ahead, upward and downward. The resulting structure has greater drag than the finely streamlined cabin of the Britannia and a slight increase in drag has also resulted from the blunt nose-cap, which is completely transparent and includes an observation and bombardier's station. Further changes to the fuselage structure have resulted from the installation of special electronic equipment beneath the nose and in the extreme tail, to which reference is made later. The main entrance door, which is situated on the port side aft of the wing, is 71in square and is divided into forward and after portions. A second large door, in a single portion, is opposite, to starboard.

In the design of the wing, Canadair adhered as far as possible to the structure of the Britannia, which is both efficient and fully proven in static and fatigue testing. Much of the Britannia wing, particularly the secondary structure aft of the rear spar, incorporates Redux bonding. Although Canadair had no previous experience of bonding techniques, the weight-penalty imposed by a switch to all-riveted construction was sufficient to make them learn.

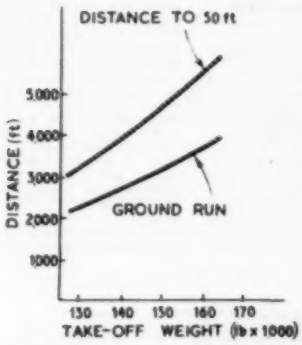
Canadair engineers visited all the principal British and American plants experienced in metal bonding, in order to determine the exact processes and equipment which would best suit their requirements. Eventually it was decided to use neither Redux nor the various bonding processes employed by their sister-company Convair, but to use Bloomingdale FM-47 as the adhesive, with techniques worked out largely by the company's own shop-engineers. A complete department was organized to make the bonded assemblies, and therein were installed a giant autoclave, hot-platen presses, tanks for cleaning and preparing the surfaces to be joined and spray booths for the application of the adhesive.

Almost the only major changes made to the Britannia wing comprise three which are confined to localized areas: the inboard main (tank-end) ribs are moved outwards so that they can serve as anchorages for the main wing pick-ups on the heavy fuselage longerons; spoilers are provided above the outer wings, as described later; and the wing is stressed to carry operational loads from pylons mounted outboard of the outer nacelles. The flap system is almost identical to that of the Britannia, large double-slotted flaps being mounted in steel guide-rails and positioned by screw-jacks driven by a central actuator *via* spanwise torque-tubes. There are eight operating jacks and, unlike the Britannia, they are of the ball-screw variety, the reduced friction of which substantially lowers the torque required for flap operation and permits an overall weight-saving of 25 lb. The flap actuator is by the Western Gear Corporation, and comprises dual electric motors coupled to a common gearbox.

In the design of the empennage Canadair have again, wherever possible, followed Bristol practice exactly. Almost the only major change is the insertion of a chordwise structural section of moulded glass laminate with a honeycomb filler, which electrically isolates the upper part of the fin and rudder and permits these portions to be used as aerials. Static testing of the new vertical tail has established that the dielectric insert is slightly more flexible than the surrounding metal structure, although it has in no way reduced the overall strength of the fin.

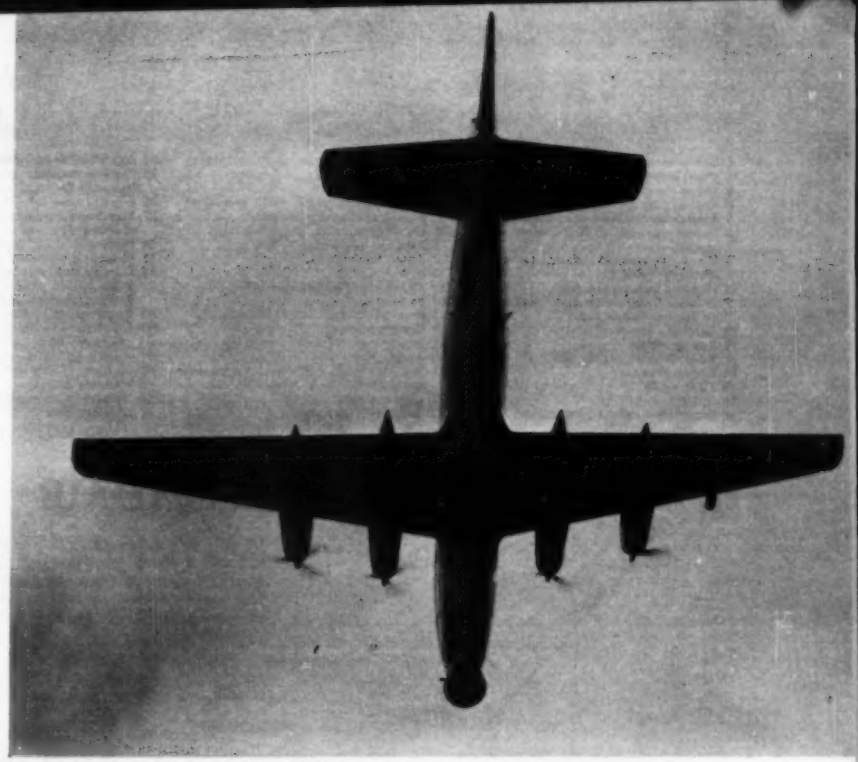
Like the Britannia, all the main flying controls are manually operated by Flettner-type servo-tabs driven through high-speed rotary torque tubes. The Britannia's interconnection between the innermost tabs on the ailerons and the rudder is retained in the Argus. The spoilers are in separate circuits which are energized whenever an extreme rate of roll is desired, particularly at low

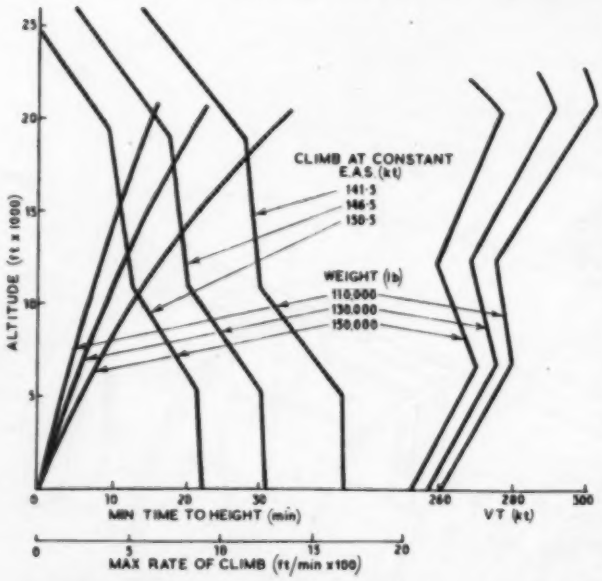
ALTITUDE (ft x 1000)



(Above) Take-off performance of the Argus: 15 deg flap; 3,700 b.h.p. at 2,900 r.p.m.; Vt.o. 1.1V$_{S1}$, Vcl 1.2V$_{S1}$, accessory allowance, 50 b.h.p. per engine.

(Below) Climb performance. Normal rated power at 2,600 r.p.m. (four engines); no flap, landing gear retracted; accessory allowance, 50 b.h.p. per engine. Right-hand curves: maximum level speed at various weights.





airspeed. The spoilers increase manœuvrability during attacks on submarines, and they are also valuable during asymmetric conditions caused by the launching of a heavy store from under one wing. The spoilers themselves are simple unperforated surfaces which are opened upwards about their leading edges (asymmetrically or together) by electric actuators in an overall operating time of 0.6 sec.

From the pilot's viewpoint an interesting feature of the Argus is its rejection of "ram's-horn" aileron controls in favour of conventional wheels of surprisingly diminutive size. The Hobson-type q-feel simulator, supplied by Jarry, is retained in the elevator circuit, and is energized by a small auxiliary hydraulic system governed by a valve-assembly sensitive to indicated airspeed. The autopilot is the Bendix (Eclipse-Pioneer division) PB-20C [*Flight*, April 12 last] which is installed as an integrated automatic flight system, a special feature of which is close-tolerance altitude retention—essential for bad-weather operations close to the sea.

One of the unusual features of the Britannia flying controls is that, should the aircraft be parked with the control-locks disengaged, the ailerons and elevators are free to droop. Moreover, although for ground-testing purposes it is possible to operate the elevators and rudder with the aircraft stationary—by opening up the inboard engines and thereby creating adequate slipstream—the Britannia ailerons cannot be properly operated on the ground unless the aircraft is taxied fast enough to create a relative airspeed of some 60 knots. Control position indicators are fitted in the Britannia flight deck. Canadair and the R.C.A.F. decided to redesign the circuits in order to permit pre-flight checks to be undertaken with the aircraft parked. The change was effected by arranging for the aileron locking cylinders to push both surfaces fully up, so that, when the locks are disengaged, the ailerons move downwards through their entire travel under the assistance of biassing springs. At the same time mechanical locking collets were incorporated in the locking cylinders, to ensure positive retention of the lock even in the event of dissipation of hydraulic pressure.

Few changes were necessary to adapt the Britannia fuel system to the piston-engined Argus, apart from the switch to 115/145-grade petrol. Total usable fuel amounts to 6,688 Imp. gal, all housed in flexible cells within the wing box. The location of these cells differs slightly from that of the Britannia 100, owing to the outward movement of the inboard root ribs and extension into the outer wings (like the Britannia 305). The cells are self-sealing, and an inerting system (to offer some protection against incendiary weapons) is under consideration. Provision is made for a rigid auxiliary tank, with a capacity of approximately 500 Imp. gal, to be installed in the forward weapons bay. For increasing the take-off power of the engines a water-injection system is provided, fed from tanks in the upper part of the nacelles.

In the design of the hydraulic system Canadair departed very considerably from the precepts laid down by Bristol. The British Messier system of the airliner operates at 4,000 lb/sq in, a pressure 1,000 lb/sq in greater than the ruling level which has in the past been standard practice in North America. The R.C.A.F. were anxious to adhere to established hydraulic components for as long as possible, particularly in view of their considerable stock supplies of 3,000 lb/sq in components available throughout Canada. Accordingly, Canadair redesigned the system to operate at 3,000 lb/sq in, and the inevitable weight penalty (actually this was held to a mere 21 lb) was more than recovered by careful design. Further substantial changes were dictated by the specified minimum operating temperature of −65 deg F (15 deg F below the required limit of the British system) and the increased number of services requiring hydraulic actuation.

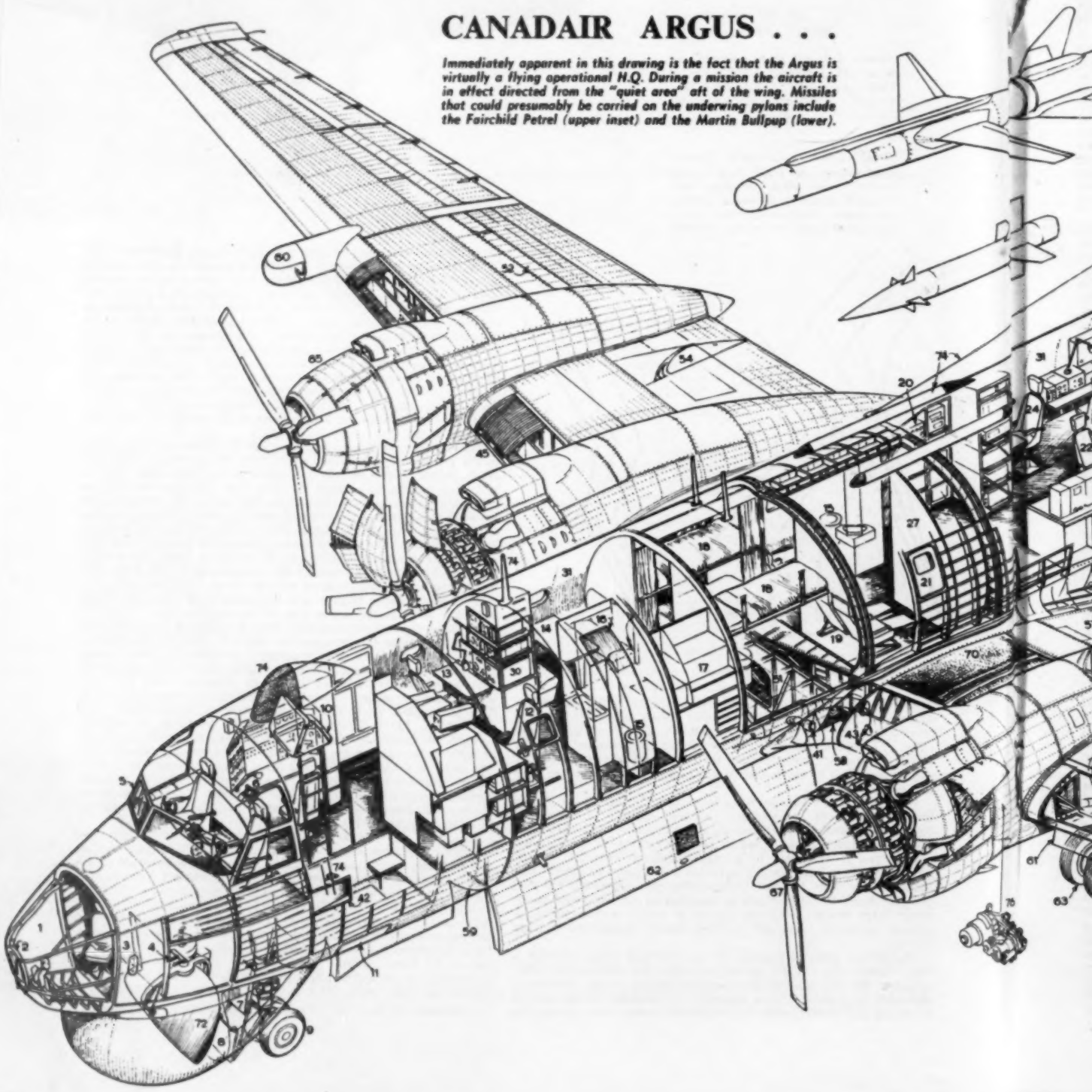
To meet the increased demands there are both main and emergency systems which serve undercarriage retraction, braking and steering, control-surface locking and weapons-bay door actuation. The main system is energized by two Vickers constant-displacement pumps of the 30-deg type (i.e., the plungers are inclined at this angle to the swash-plate, which is perpendicular to the drive-shaft), which are mounted on accessory boxes driven from the inboard engines. Each box is maintained at constant r.p.m. by a Sundstrand constant-speed drive, and the Vickers pumps deliver 7.1 Imp. gal/min at 3,300 r.p.m. Pipe-joints and fittings are similar to the Ermeto flareless type, holding line weights to a minimum. The main reservoir is pneumatically pressurized to

(Continued on page 548, after double-page drawing of the Argus)

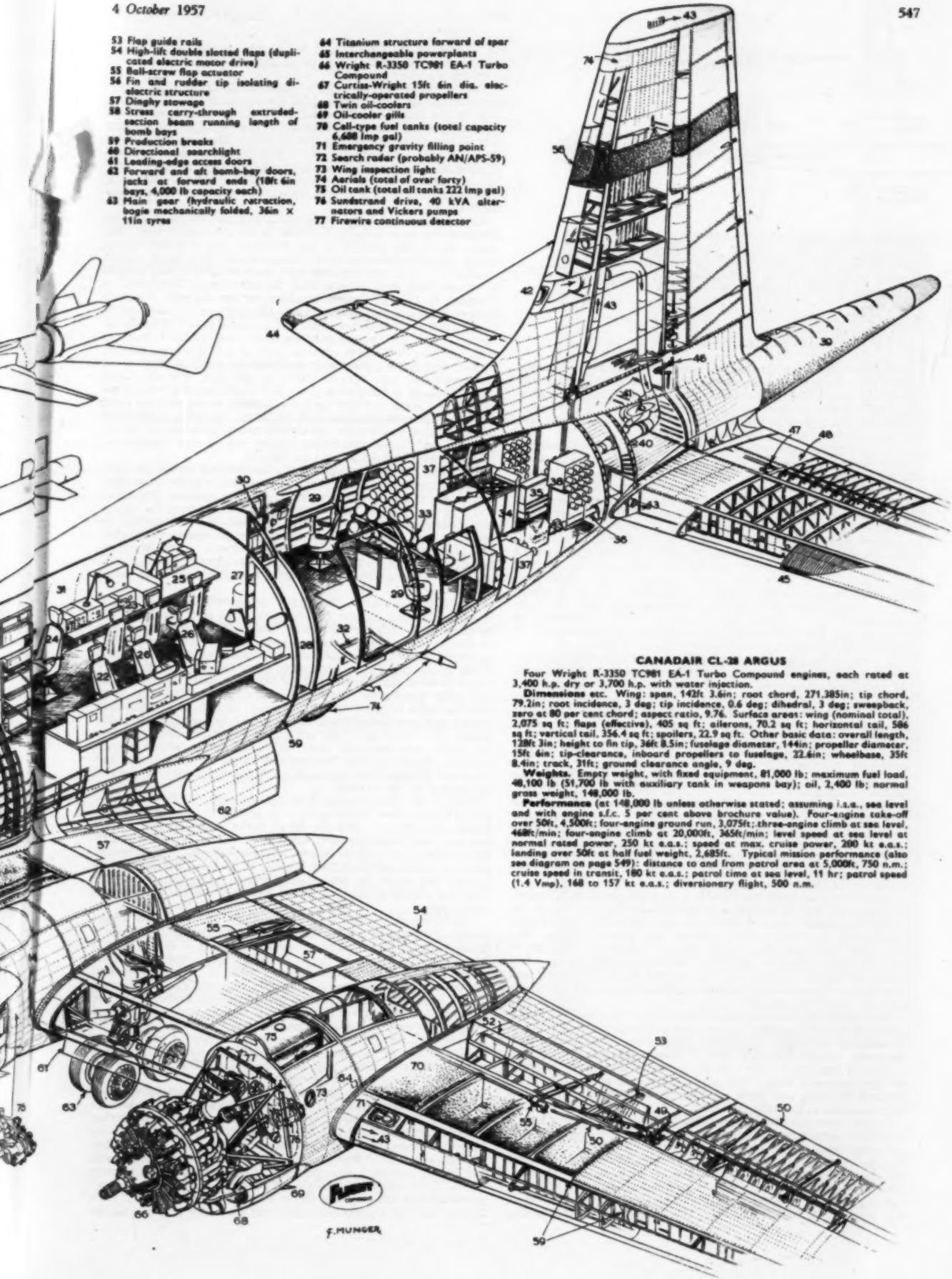
1 Bomb aimer's forward station
2 Electrically-heated window
3 Static vents
4 Pressure heads for q-feel system
5 Electrically-heated windscreen
6 Power controls at flight engineer's station
7 Inner nosewheel door to take ditching loads
8 Outer doors in radome
9 Britannia undercarriage "reversed" to retract rearward
10 Ditching hatch
11 Lower hatch
12 Routine navigator's station
13 Radio operator
14 Mess table
15 Toilets
16 Stainless-steel ice protection
17 Galley (refrigerator, oven, hotplate)
18 Bunks
19 Sleeperette seats
20 Main distribution and electrical panel (port and starboard)
21 Emergency exits
22 Tactical navigator
23 Radar operator
24 Search radar
25 Magnetic detector operator
26 Sonobuoy operator
27 Emergency equipment stowage
28 Coat stowage
29 Beam search station
30 Radio racks
31 Soundproofing (aluminium tape and glass-fibre)
32 Camera hatch
33 Sonobuoy dispenser
34 A.S.W. stowage/dispenser
35 Marine marker pneumatic (3,000 lb/sq in) Retro ejector
36 Ejector tube for (35)
37 Sonobuoy stowage racks (port and starboard)
38 Marine-marker stowage racks
39 Magnetic airborne detector
40 Combustion heater for tail anti-icing (three others in fuselage for wing anti-icing and cabin heating)
41 Combustion-heater exhaust
42 Combustion-heater intake (electrically anti-iced)
43 Anti-icing hot air circulation
44 Napier Spraymat anti-icing on elevator horns
45 Thermal anti-icing, leading-edge corrugations
46 Rudder servo-tab linkage, trim by spring bias (see 47)
47 Elevator servo-tab linkage. (Normal Britannia system of manual control by servo-tabs on all surfaces. Trim by spring bias.) q-feel on elevator. Bendix PB-20C autopilot
48 Elevators interchangeable
49 Aileron servo-tab linkage (see 47)
50 Inner aileron ab interconnected with rudder to give increased dihedral effect in yaw
51 Main hydraulic (engine driven) supply panel on this bulkhead accessible in flight. Emergency system (electrically driven) on rear spar
52 Spoilers, differentially applied with full aileron deflection

CANADAIR ARGUS . . .

Immediately apparent in this drawing is the fact that the Argus is virtually a flying operational H.Q. During a mission the aircraft is in effect directed from the "quiet area" aft of the wing. Missiles that could presumably be carried on the underwing pylons include the Fairchild Petrel (upper inset) and the Martin Bullpup (lower).



53 Flap guide rails
54 High-lift double slotted flaps (duplicated electric motor drive)
55 Ball-screw flap actuator
56 Fin and rudder tip isolating dielectric structure
57 Dinghy stowage
58 Stress carry-through extruded-section beam running length of bomb bays
59 Production breaks
60 Directional searchlight
61 Leading-edge access doors
62 Forward and aft bomb-bay doors, jacks at forward ends (18ft 6in bays, 4,000 lb capacity each)
63 Main gear (hydraulic retraction, bogie mechanically folded, 36in × 11in tyres
64 Titanium structure forward of spar
65 Interchangeable powerplants
66 Wright R-3350 TC9B1 EA-1 Turbo Compound
67 Curtiss-Wright 15ft 6in dia. electrically-operated propellers
68 Twin oil-coolers
69 Oil-cooler gills
70 Cell-type fuel tanks (total capacity 6,688 Imp gal)
71 Emergency gravity filling point
72 Search radar (probably AN/APS-59)
73 Wing inspection light
74 Aerials (total of over forty)
75 Oil tank (total all tanks 222 Imp gal)
76 Sundstrand drive, 40 kVA alternators and Vickers pumps
77 Firewire continuous detector



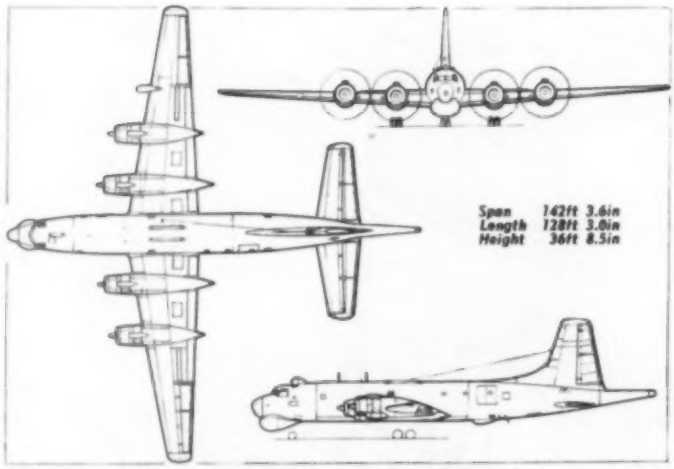
CANADAIR CL-28 ARGUS

Four Wright R-3350 TC9B1 EA-1 Turbo Compound engines, each rated at 3,400 h.p. dry or 3,700 h.p. with water injection.

Dimensions etc. Wing: span, 142ft 3.6in; root chord, 271.385in; tip chord, 79.2in; root incidence, 3 deg; tip incidence, 0.6 deg; dihedral, 3 deg; sweepback, zero at 80 per cent chord; aspect ratio, 9.76. Surface areas: wing (nominal total), 2,075 sq ft; flaps (effective), 405 sq ft; ailerons, 70.2 sq ft; horizontal tail, 586 sq ft; vertical tail, 356.4 sq ft; spoilers, 22.9 sq ft. Other basic data: overall length, 128ft 3in; height to fin tip, 36ft 8.5in; fuselage diameter, 144in; propeller diameter, 15ft 6in; tip-clearance, inboard propellers to fuselage, 22.6in; wheelbase, 35ft 8.4in; track, 31ft; ground clearance angle, 9 deg.

Weights. Empty weight, with fixed equipment, 81,000 lb; maximum fuel load, 48,100 lb (51,700 lb with auxiliary tank in weapons bay); oil, 2,400 lb; normal gross weight, 148,000 lb.

Performance (at 148,000 lb unless otherwise stated; assuming i.s.a., sea level and with engine s.f.c. 5 per cent above brochure value). Four-engine take-off over 50ft, 4,500ft; four-engine ground run, 3,075ft; three-engine climb at sea level, 468ft/min; four-engine climb at 20,000ft, 365ft/min; level speed at sea level at normal rated power, 250 kt e.a.s.; speed at max. cruise power, 280 kt e.a.s.; landing over 50ft at half fuel weight, 2,685ft. Typical mission performance (also see diagram on page 549): distance to and from patrol area at 5,000ft, 750 n.m.; cruise speed in transit, 180 kt e.a.s.; patrol time at sea level, 11 hr; patrol speed (1.4 V_{mp}), 168 to 157 kt e.a.s.; diversionary flight, 500 n.m.



CANADAIR ARGUS...

12 lb/sq in above ambient and, as far as possible, all components have been made accessible in flight; in particular, electrically operated valves, such as those in the main and emergency undercarriage circuits, are provided with manual over-rides. The principal hydraulic panel is grouped on the forward face of the rear bulkhead of the forward weapons-bay.

The emergency system has, as far as possible, been run remotely from the main system to minimize the chance of both services being knocked out during combat. Energized by a third Vickers pump, driven by a 17 h.p., 400 c/s. electric motor, the emergency system can extend the undercarriage, operate wheel brakes and weapons-bay doors and energize the emergency accumulator which provides for up to eight applications of wheel brakes. The emergency-system panel is mounted on the rear wing spar and, like the main panel, is accessible in flight. In order to keep all emergency-system units continuously serviceable they are operated either partially or fully even during non-emergency conditions. The flight engineer is in charge of a three-way switch with which he can select either the main or emergency system or shut both systems off. A third, localized auxiliary system is provided to energize the q-feel simulator in the elevator-control circuit. It includes an *ad hoc* electrically driven hydraulic pump.

A completely new system for the Argus is the pneumatic circuit, developed for the ejection of sonobuoys (a self-contained device for detecting submerged submarines). As far as Canadair are aware the Argus was the first aircraft to be designed with provision for the power ejection of the largest type of sonobuoys at a known velocity (the smaller types have previously been ejected pneumatically). The ejection is accomplished by a "pogo-stick" free-piston actuator, which accelerates the stores gently without damaging their delicate electronic circuits yet imparts a velocity high enough to ensure that they leave the aircraft cleanly. The system is energized by a 3,000 lb/sq in electrically driven compressor, and it includes a small electro-pneumatic actuator for the skin door through which the sonobuoys are ejected. A separate pneumatic circuit is included in the Retro Marine Marker Ejector system which is referred to later. All these pneumatic devices are produced by the Stratos Division of Fairchild. A subsidiary function is that they pressurize the main emergency hydraulic reservoirs of the feel simulator reservoir.

Main electrical loads are met by a fully paralleled A.C. system supplied by four Westinghouse 40-kVA alternators, which are turned at constant speed by the Sundstrand variable-ratio hydraulic packs which are shaft-driven from the rear of each engine. The alternators generate three-phase 400 c/s. current at 208/120 V, and are fully protected and have automatic load-sharing. Any three alternators can maintain full aircraft loads indefinitely and the complete generating system is capable of a 150 per cent overload for up to five minutes.

Secondary D.C. requirements are provided by rectifiers and a stand-by battery system. In addition to the considerable list of operational electronic equipments discussed later—and which generally require supplies with a closely controlled frequency—a heavy load can be taken by the powerful searchlight mounted on the starboard wing. The aggregate length of primary cable exceeds 60 miles, and there are more than 5,000 separate circuits each of which is individually coded.

In the Britannia a substantial flow of hot air is tapped from a manifold surrounding the turbine section of each Proteus turboprop and used, either direct or *via* a heat exchanger, to provide thermal de-icing of the wing leading edge and other parts of the airframe. Being denied such a source of heat, the Argus is equipped with four Janitrol combustion heaters fed with fuel from the main tanks. The aggregate heating capacity amounts to no less than 2,100,000 B.Th.U./hr. This output is required to heat the interior of the aircraft and to provide thermal anti-icing of the wings and control surfaces in all climatic conditions down to −65 deg F.

Two of the largest heaters are mounted along the sides of the forward fuselage where they are fed through flush intakes immediately to the rear of the flight deck. The leading edges of the fin and tailplane are anti-iced by hot air from a heater in the extreme rear of the fuselage; but, like the Britannia, the horn balances of the elevators are provided with Napier Spraymats. Electro-thermal de-icing is provided for the propellers and the combustion-heater intakes, and electric heating is also used for anti-icing, de-frosting and de-misting the transparent areas of the nose and flight deck.

Crew comfort is a factor of paramount importance in an aircraft designed for such lengthy missions in difficult conditions. The sheer size of the interior of the Britannia was a useful legacy, which in itself makes the Argus a comfortable and roomy vehicle in which to work; but Canadair have gone to considerable lengths to ensure that crew fatigue shall be minimized. According to Thomas A. Harvie, project engineer on the aircraft, "decibels may not mean anything in measuring comfort level," and quantitative decibel measurements were not accorded much importance. Instead, each part of the working space was assessed from all angles to give reasonable comfort without giving undue priority to any one factor. Damping of the skin panels is effected by aluminium-foil tape applied direct to the skin, and the entire usable fuselage is lined with glass-fibre insulation, the weight per square foot being carefully graded according to the incident noise intensity. Interior equipment is resiliently mounted, usually on rubber-bushed shock units. As already noted, the cabin-air system incorporates a large combustion heater, and all crew-stations are provided with individual cold air louvres.

The large drawing clearly shows the interior layout provided for the operating crew of up to 15. A normal routine crew comprises two pilots, a flight engineer, a radio operator (signaller), and a navigator. The tactical complement varies with the equipment installed and the mission to be flown, but stations can be provided for a total of eight in the tactical compartment in addition to the search stations in the beam positions. A typical operational crew comprises three pilots, three navigators, two engineers, and seven signallers engaged in communications and radar operations.

On lengthy missions the Argus crews will be divided into watches like their marine counterparts: two crew-members will be assigned to each tactical station, and the man not on duty will be able to settle down in the rest-area, which is larger and better equipped than any previously seen in a military aircraft. Although it lies in the plane of the propeller discs the rest-area is heavily sound-proofed and provides space for four bunks or two bunks and eight "sleeperette" seats. A dining table is provided for four, together with a galley which can cook food from scratch (not merely heat pre-cooked food) together with refrigeration and cold storage, hot plates and other equipment capable of preparing two hot meals and one cold meal for each crew-member on each mission. Notes on the "operational" areas of the interior are discussed following the next section, which deals with the combat equipment of the aircraft.

Each of the two weapons-bays has a length of 18ft 6in and is closed by two doors actuated by jacks at their forward ends which swing over-centre to lock the doors in the closed position. Each bay can carry approximately 4,000 lb of stores, comprising such diverse devices as ballistic bombs, torpedoes, depth charges, mines, practice bombs and photoflash bombs. In addition, structural provisions are made for under-wing pylons upon which can be mounted guided missiles, unguided rockets and various heavy and bulky stores.

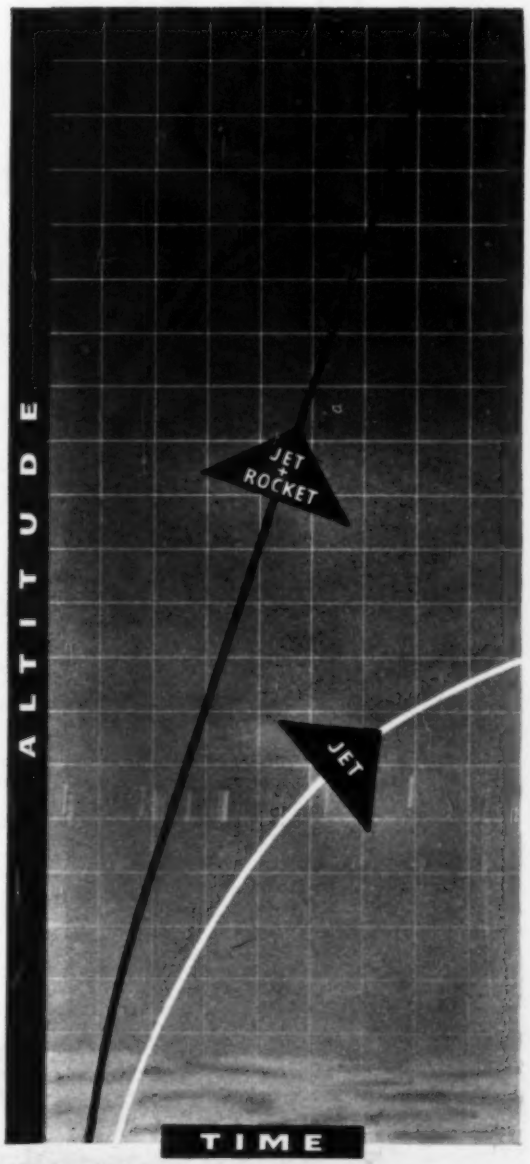
These external loads may well include the Fairchild Petrel missile. Powered by a Fairchild J44 turbojet, Petrel is a descendant of the German Henschel air-to-surface weapons of World War 2, from which it differs in that it sheds its wings and powerplant under a signal from a radar altimeter when in close proximity to the water, finally behaving as a homing torpedo. Petrel is already in use with the U.S. Navy. Another weapon suitable for the Argus is the Bullpup, by The Martin Company, which is a tactical weapon powered by a solid-propellant motor and weighing 600 lb. Ballistic (i.e., free-falling) weapons can be employed in a manner similar to that of the most advanced bomber aircraft, the Argus being capable of visual and blind bombing. The Argus is not designed to carry gun armament.

At the extreme rear of the usable fuselage is a special dispensing area wherein are carried and launched sonobuoys, long-endurance and short-burning marine markers, parachute flares and other pyrotechnics. All these stores can be ejected with positive velocity by devices energized by the pneumatic system previously referred to. The larger sonobuoys are manually withdrawn from their racks and loaded one at a time into one of the four inclined ejectors which "fire" obliquely through the floor and out through electro-pneumatically actuated skin-doors beneath the aft fuselage. Each ejector contains a pneumatic tube housing a free piston, a lug on

PERFORMANCE AT ALTITUDE—

THE KEY TO MODERN INTERCEPTION

A significant limit to the effectiveness of interception has formerly been set by the fall-off in thrust of the pure jet at high altitude. Saunders-Roe set themselves to break beyond that limit by the evolution and development of the mixed-unit principle, using both jet and rocket propulsion. The recently-demonstrated success in prototype of this development has more than justified the energy with which Saunders-Roe have pursued it.

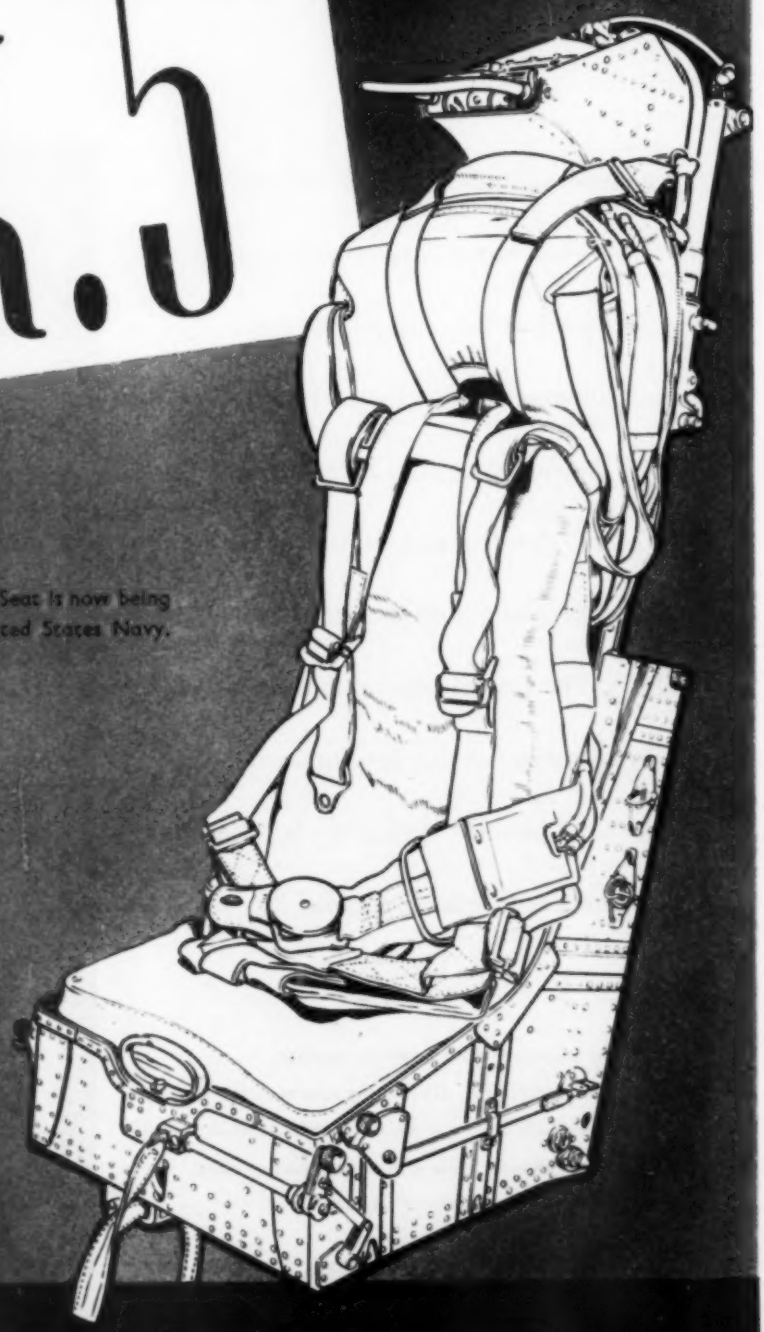


Consider the mixed-unit principle as applied to TIME TO HEIGHT. During the course of the climb when altitude begins to rob the jet of its thrust, that of the rocket is improving; thus a very high rate of climb is maintained up to extremes of altitude.

SAUNDERS-ROE *Limited*

ORIGINATORS OF MIXED-UNIT INTERCEPTION

Mk.5



The Martin-Baker Mk.5 Ejection Seat is now being delivered in quantity to the United States Navy.

MARTIN-BAKER

Aircraft Company Limited

England & Canada

CANADAIR ARGUS...

which projects from a slot in the tube and engages with the store. The velocity imparted to the sonobuoy is carefully controlled to take the device clear of the aircraft without endangering its delicate mechanisms. The smaller sonobuoys can be launched through any of six vertical tubes.

The Retro Marine Marker Ejector system, however, is specially designed to impart to marine markers and flares a velocity which either precisely cancels out the forward motion of the aircraft, and thus causes the device to drop vertically or, alternatively, which "shoots" the marker along a planned trajectory so that it will hit an exact point of the ocean's surface. (Previously all such stores have been loosely aimed by releasing them at the correct point for a ballistic trajectory.)

One of the bulkiest pieces of equipment, and one which gives the aircraft a distinctive appearance in the air, is the search radar installation which is mounted in the optimum position beneath the nose. Details of the equipment are security-classified, but it seems fairly obvious that the set is the long-established APS-59, also carried by such aircraft as the Skyraider and Neptune (and in service with the R.C.A.F. with the latter machine). One would expect that a later radar will become available during the life of the Argus. As the large drawing shows, the scanner is housed in a dielectric radome made from glass-fibre laminates arranged as a sandwich with a honeycomb core of the same material. Similar construction is used for the 15ft-long fairing (which forms a "stinger"-type tail) over the magnetic airborne detection equipment, or MAD gear, which can locate submerged submarines.

According to Canadair, "tactical electronic equipment can be fitted for detection, localization and tracking in accordance with customer requirements." Excluding communications and navigational equipment, tactical electronic devices account for a total weight of no less than 3,650 lb; their development has necessitated the evolution of a variety of advanced wave-guide systems, aerials, and radomes, and they utilize the majority of the 41 aerials which the Argus carries.

One of the most important of the navigational aids is ANTAC, a long-range system developed by Computing Devices of Canada. In our "Flying Aids" issue (April 12 last) we reported that "The Air Navigation and Tactical Control System embodies a long-range navigation system coupled to an integrated tactical display, and is designed for use in the CL-28 Argus maritime reconnaissance aircraft. The navigation unit is a large dead-reckoning computer giving ground-position in latitude and longitude with provision for external references from a variety of electronic, radar and radio inputs. Steering signals to the autopilot can be provided automatically or semi-automatically and a co-ordinated picture of the tactical situation is displayed for the navigator."

The conventional navigational aids include Loran, and provision for Tacan, together with dual radio compasses (fed from a "silhouette" aerial system), a marker-beacon receiver and V.H.F. and U.H.F. homing adaptors, together with G.P.I. and instrument presentations specially designed for maritime use. Communications equipment includes duplicated H.F. command equipment (the H.F. aerial is the isolated top of the vertical tail) a V.H.F. command set and, if needed, U.H.F. also. Provision is made for a Sarah (Ultra's "Search And Rescue And Homing") receiver, and the comprehensive intercommunication system includes outlets serving leads to the ground crew.

An accompanying diagram illustrates graphically the types of mission which the Argus can accomplish. From this it is clear that it is one of the longest-ranged military aircraft in the world; it is certainly a machine with a flight-endurance which can exceed 30 hr, when endurance—as distinct from range—is the dominant factor. The flight engineer, whose panel is quite different from that of the Britannia, is provided with a large number of sensitive engine instruments to permit refined cruise-control techniques to be followed precisely. During normal cruising flight the aircraft is controlled from the flight deck and the routine navigation compartment, but in combat the nerve-centre of the Argus is the tactical compartment, located aft of the wing in the quietest part of the aircraft. This compartment is the main avionic control-room with the tactical equipment disposed along each wall under the control of operators seated in chairs which can move along rails inset into the floor. At the front, on the starboard side, is the seat for the tactical navigator who assumes command of the aircraft when a submarine contact is made.

Altogether the engineering programme necessary to develop the Argus involved almost 19,000 drawings which defined some 70,000 detail parts. Over 10,000 of the drawings originated at Canadair, the remainder being Bristol drawings converted to North American standards of projection, tolerances and specifications. The total effort was equivalent to about 1,000 man-years, the engineering strength reaching a peak of about 530 for a period of one year. Throughout the whole process the programme retained flexibility, and during the engineering of the Argus over 100 major specification changes were negotiated and absorbed. It is a particularly commendable fact that the final Argus has a gross weight which adheres to that originally specified, notwithstanding the fact that the evolution of the aircraft—which will continue for a long time to come—is a live process which must always be capable of accommodating ever-increasing amounts of equipment, much of which did not exist when the design was originally planned. It is also worth reiterating that the engineering design, manufacture, flight test programme and production programme of the Argus has been on schedule throughout.

While the first machine was in the detail-design stage development was proceeding intensively upon all the systems which the aircraft introduced. Interior arrangement was naturally worked out in co-operation with the R.C.A.F. with the use of a full-scale mock-up, which has since been employed to assist the engineering development of later weapon systems associated with the aircraft. Extensive tunnel testing was necessary to perfect the aerodynamics of the aircraft, and hydro-dynamic tests were needed to prove the ditching characteristics. The powerplant rig has already been referred to, and an additional test stand was developed for the lubrication system which was investigated under simulated altitude conditions.

An omni-attitude fuel-system rig was subjected to comprehensive tests involving all phases of aircraft operation, and a somewhat similar bench rig was necessary for the hydraulic system. A photograph on page 545 shows a model used in the development of the Argus aerial systems, this being only one of many aspects of the electronic-development programme. A complete three-dimensional rig, representing an investment of almost $400,000, was necessary for the extensive electrical system, and much additional time was also required for the development of the heating, ventilating and anti-icing systems.

Structural testing involved not only the Argus airframe but also a fair amount of research into the shop-processes associated with titanium alloys, bonded assemblies and 79S material. Complete static testing has been undertaken with the second Argus airframe, which has proved most of the design cases and will shortly be tested to destruction. Rubber water bags with carefully controlled interior pressure have been extensively employed to simulate air and water loads. This technique was used in the static-test programme on the large radome, which showed little permanent set under ultimate conditions and eventually parted from its periphery at 129 per cent of the ultimate load. Fatigue testing has been largely investigated with *ad hoc* detail sections, among which were several units of either riveted or bonded construction which have enabled comparisons to be made between the two types of structure.

Canadair are retaining the first Argus for a comprehensive development programme which will probably extend throughout the life of the aircraft. Phase-I testing, occupying 67 flight hours, has now been successfully completed, and the way is open for this aircraft (No. 20710) to acquire excrescences associated with future tactical developments which will probably be incorporated on the production line. The third aircraft was due to be handed over to the R.C.A.F. for test work this week, and the remainder of the initial orders—of 13 and 12 aircraft, respectively—are following at a steady rate during 1958.

In the Argus the R.C.A.F. have an aeroplane which in its own sphere is unmatched by anything else at present flying. This account has given some indication of the inherent versatility of the design, and there is no doubt that there are many nations, particularly those with an extensive sea-board or important maritime trade, who would buy the aircraft if they had the opportunity to do so. In particular, the rôles for which the Argus has been designed are such that it will be very difficult to find a better machine for the job for a good many years to come.

Typical missions: The vast range of the Argus illustrated. (1) 500 n.m. diversion assumed in all cases. (2) 200 n.m. (3) Two circuits of each course, or eight circuits of the shorter. (4) 40 n.m. sweep assumed in all cases. (5) 72,000 sq n.m. patrol. (6) 52,000 sq n.m. patrol. (7) 3.6 hr transit. (8) 3.6 hr action. (9) 3,300 n.m. coastal patrol.

STRIKEBACK

ACK

HERE, conveyed with a strong tang of the sea, is U.S.S. "Saratoga" at work in the recent NATO exercise "Strikeback." At upper left a Douglas A3D Skywarrior gets under way from the port steam catapult, with Douglas AD Skyraiders and a Douglas F4D Skyray in the foreground. At far left, a Skywarrior is seen on the approach, with others of its kind, plus a Skyraider, also in the picture. Above—again with Skywarriors prominent —a destroyer refuels at sea; and on the immediate left is a characteristic delta approach by a Skyray.

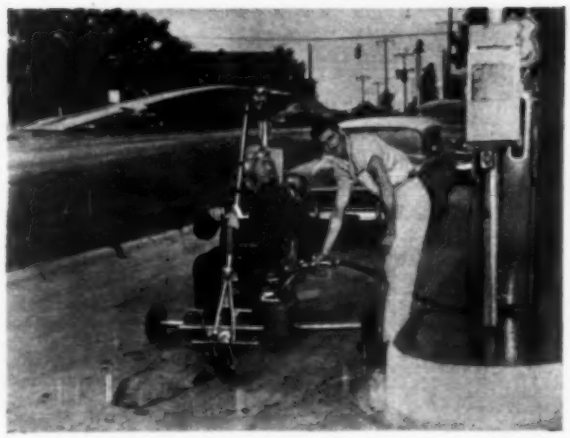
Roadable Aircraft

MORE AMERICAN ENDEAVOURS TO MAKE THE BEST OF BOTH WORLDS

PERHAPS by reason of the spider's web of official red tape in which an owner would almost certainly find himself enmeshed, few attempts have been made in this country to construct so-called roadable aircraft. In America such ventures have been of frequent occurrence, though most of the designs have rapidly faded into obscurity after an initial blaze of publicity.

On this page are seen three of the most recent transatlantic efforts. At the top is a high-wing design by Waldo Waterman of San Diego, said to be capable of 130 m.p.h. in the air and 70 m.p.h. on the road, on the power of a 165 h.p. engine. It bears the unprepossessing name of Aerobile. The two centre pictures are air and road impressions of Leland Bryan's Autoplane, built from standard Ercoupe parts and said to be such a familiar sight on the roads round Milford, Mich., that local motorists do not give it a second glance. Road and air speeds of 60 and 95 m.p.h. are claimed.

The fourth photograph is of a more truly professional venture, this time by Igor Bensen, founder of Bensen Aircraft Corporation, makers of light helicopters. Known as the B-7M Gyro-Copter (40 h.p. Nelson H-59 engine), it was recently the subject of a demonstration in which Bensen flew 15 miles from his factory into the suburbs of Raleigh, North Carolina, landed, filled up at a petrol station (see picture), visited a bank, and went shopping.



GAS TURBINE VIBRATION INDICATOR

IGNITION analysers for piston engines have been in wide use for a number of years; and the Sperry Gyroscope Co., Ltd., has now produced an equivalent device for gas turbine engines. Known as the Sperry turbine engine vibration indicator, it senses any vibration in an engine which may indicate impending failure.

The Sperry equipment has been designed specifically for use as a permanently mounted aircraft installation to give continuous vibration indications and alarm signals in flight. It consists of a pick-up of the seismic type, with a velocity output, and which can be mounted anywhere on the engine; an amplifier to process the signals; and a galvanometer dial to give readable indications. An adjustable trip-circuit can be included to set off an alarm when vibration exceeds a preset level. With plug-in amplifiers, filter assemblies and selector switches this basic equipment can be adapted to suit any type of engine installation.

The pick-up has a base 2.5in high and a diameter of 1.5in; it weighs 0.5 lb and has a temperature range from −55 deg C to 270 deg C. Valve amplifiers are used to give stability at low frequencies and over wide temperature ranges. Maximum weight for a composite installation would be 18.5 lb and power requirements 32 W at 115 V, 400 c/s.

MARCONI FREQUENCY STANDARD

A FREQUENCY standard believed to provide the highest degree of stability so far obtained by quartz control in an item of production equipment is now being marketed by Marconi's Wireless Telegraph Co., Ltd. It was exhibited at the Western Electronic Convention in San Francisco last month, and has already aroused great interest in many countries. The standard achieves weekly stabilities to within two parts of 10^{10} and, in observatories and laboratories, can serve as an operational standard checked occasionally by an atomic resonance. It can also be used as the master control to monitor such navigational aids as Loran and Gee.

The full title of the new equipment is Marconi Quartz Servo Frequency-Standard Equipment, Type R.D.101. It weighs 440 lb, has a power consumption of about 500 VA, produces outputs at 10 Mc/s, 1 Mc/s and 0.1 Mc/s with at least 1 V (r.m.s.) into 75 Ohms. Open construction with "slide out and tilt" panels, full metering facilities and the possibility of servicing without interrupting operation are attractive features. Inter-Services preferred valves have been used. A high-precision Marconi 5 Mc/s crystal, noted for low drift rate and immunity from vibration effects, is employed.

TIP THRUST UNITS FOR THE 'SKEETER'

Napier helicopter tip thrust units, using liquid propellant, have been fitted to the Saunders Roe 'Skeeter' light helicopter. They are the simplest, lightest and most compact means of providing additional independent power for the special conditions experienced in helicopter operations.

'SCORPION' FOR THE CANBERRA

Installed in the belly of an English Electric Canberra, the 'Scorpion' rocket engine is used as a boost for additional thrust at take-off and at high altitudes. Rocket engines are also a source of extra speed for fighter aircraft in combat.

POWER FOR TOMORROW'S AIRCRAFT

Following the success of the Napier thermal ignition engine as a propulsion unit for guided missiles, Napier are now developing a range of rocket engines for high-speed piloted aircraft. Operating on gas-turbine fuel and high-strength hydrogen peroxide, these engines are capable of repeated start-stop sequences with complete reliability at any altitude. *Napier engineers are also engaged on the design and development of ram jet engines for aircraft propulsion.*

NAPIER

ROCKET ENGINES · TIP THRUST UNITS
RAM JET ENGINES

STILL BREAKING RECORDS!

In September it was announced that a double Scorpion aircraft rocket engine designed, developed and produced by Napier and fitted to a Canberra B2 set up a new world aeroplane height record of **70,325 ft.**

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● DUNLOP RUBBER COMPANY LIMITED · (AVIATION DIVISIO

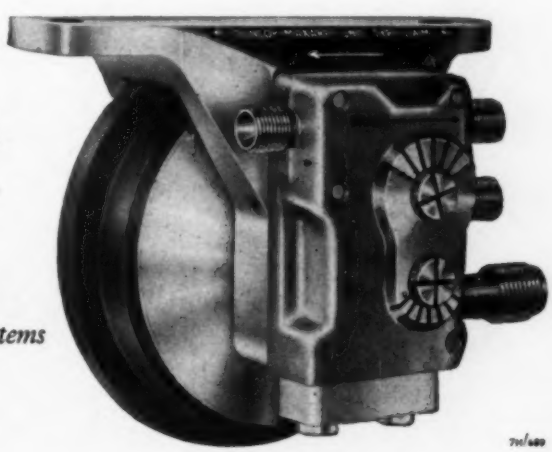
Duck baffled by landing on ice.
Reproduced from a 'shot' in the
Walt Disney film, "THE VANISHING PRAIRIE"
(Copyright WALT DISNEY MICKEY MOUSE LTD.)

anticipating the unexpected...

EVEN the natural instincts of the wild-fowl are sometimes baffled by the unexpected. Just as in landing even the most experienced among pilots can seldom anticipate the moment when a skid may occur.

With 'Maxaret' Anti-Skid control the pilot need have no such anxiety. As soon as the wheels approach the point of skidding, the 'Maxaret' units automatically release the brake pressure until forward speed is regained. In the event of a "bounce" landing, brakes are "held-off" until contact with the runway is again established.

Here, then, is equipment—conveniently small and compact—which is an important contribution to safer and more efficient braking, particularly on wet and slippery surfaces. Every designer, every aircraft manufacturer, should specify '*Maxaret*' Anti-Skid Units.



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THE AERONAUTICAL BOOKSHELF

"Unarmed into Battle," by Major General H. J. Parham and E. M. G. Belfield. The Air O.P. Officers' Association, R.A.F. Middle Wallop, nr. Stockbridge, Hants. Illustrated. Price 25s.

NOW that the Army again has its own private air force after almost 40 years, this story of the work done by Auster A.O.P. units in World War II has an added interest. All too little publicity has been given to the achievements of the men in khaki who flew these small unarmed monoplanes on almost every battle-front from North Africa to Sicily, Italy, Normandy and Burma, or to the men in R.A.F. blue who kept the aircraft serviceable under conditions for which they were never designed. Now all that has been put right by a book which tells the story factually, accurately and with a completeness that leaves nothing to be desired. The appendices, indeed, list everything from specifications of the Austers to brief histories of the twelve A.O.P. squadrons and a record of all officers who attended Air O.P. courses.

Considering that the use of aeroplanes as air observation posts was considered to be their only military application in the pioneer days, it is incredible to read of the opposition that had to be overcome before the force could be reborn following the disastrous experience of trying to do the job with sophisticated, relatively high-powered Lysanders in May 1940. Even as late as March 1941 higher authority in the Royal Air Force still believed that the one and only Army A.O.P. Flight should be disbanded, and it required the personal intervention of Lord Alanbrooke, himself a gunner, to keep it alive.

It was decided originally to equip the force with Vultee-Stinson Vigilants; but the first batch were shipped, crated, under hundreds of tons of cheese, and all but one or two arrived flat. So the Army switched to the British Taylorcraft, then a very inadequate second-best, but destined to develop eventually into the sturdy, more efficient Auster.

Soon the A.O.P. squadrons proved their mettle. In Tunisia, Captain MacGrath was set upon by five Fw 190s and adopted what was later to become a standard method of defence—he circled like a fly in a jampot inside a hollow in the hills where his faster opponents could not follow. At Catania, a spotting job for the Navy led to a decision to call in the Air O.P. whenever the fleet carried out a shoot against land targets in later campaigns. As a result, Von Rundstedt wrote of the Normandy battle that "During the day (the naval) fire is skilfully directed by air observers and by advanced ground parties. The movement of tanks by day in open country within naval gun range is scarcely possible."

There are countless stories of gallantry and success in action; and at the end of the war the squadrons had the satisfaction of hearing from Field Marshal Montgomery that "The Air O.P. has become a necessary part of gunnery". He added that "Primarily an Air O.P. officer must be a good gunner—it is not difficult to teach him to fly," which was itself a tribute to the Auster.

Success cost the lives of 61 men, and at least a quarter of the operational casualties were caused by the ever-present hazard of being hit by shells from the guns whose fire they were directing. But without both success and sacrifice there would not have been an Army Air Corps today. J.W.R.T.

"R.A.F. Biggin Hill," by Graham Wallace. Putnam and Co., Ltd., 42 Great Russell Street, London, W.C.1. Illustrated. Price 21s.

IT was by chance that a stretch of North Downs grassland, close to Biggin Hill village and overlooking the Weald of Kent, was chosen one afternoon late in the autumn of 1916 as an aerodrome. No one thought then about its usefulness as a base to shield London from air raids. Instead, it was a convenient place to which to move the Royal Flying Corps' Wireless Testing Park—a unit which, in liaison with the Army, had been tinkering about with radio on a small, damp aerodrome at Joyce Green, near Dartford. The value of wireless in the air war had finally been recognized, and there was a pressing need for the new equipment. So, to get on with the job and away from the frustrations and exasperations brought on by the diehards of Army Signals, the R.F.C. unit founded its own headquarters at Biggin Hill.

It is from this beginning that Graham Wallace has traced the story of this famous aerodrome. He has painstakingly unearthed its history and has revived it in a lively manner, not skimping over the years before 1940, and recalling the many developments in air warfare made between the wars. There was the first demonstration of radio-telephony before the Institute of Electrical Engineers; the day in August 1919 when an assembly of peers, M.P.s and Government officials were addressed by an officer flying 20 miles away; the early attempts at radio location, and the building of a 20ft-wide concrete sound projector which, by blaring forth with a 10kW klaxon audible to a pilot on the approach, provided a crude form of blind let-down.

Long before the Second World War, Biggin Hill had become one of the foremost fighter bases, but the scientific work there continued. It was a sensible partnership, for it was the fighter pilots who were to use the inventions being developed by the scientists.

All through this history Mr. Wallace introduces both shafts of humour and stunning moments of poignancy. He sees the life of the aerodrome through the eyes of commanders, officers, airmen and airwomen. He records some of the R.F.C. songs; he quotes the reply of a young pilot who, asked by Trenchard in the mid-twenties what he would do with his new radio-telephone set if war came, said: "Chuck the apparatus right out of my aircraft, sir"; he quotes exuberant extracts from squadron diaries ("later we intercepted, without any exaggeration, a total of at least 20,000 assorted Huns . . ."); and he reports the scene at a mass funeral service carried out at the height of an air raid.

With its simple title, *R.A.F. Biggin Hill* is an inspiring story written with a great regard for the truth; though perhaps a few incidents may not be quite accurate. To those who knew the aerodrome it will bring a feeling of nostalgia; those who did not will find it enthralling. A.C.B.

"Men with Wings," by W/C. "Sandy" Powell. Allan Wingate (Publishers), Ltd., 12 Beauchamp Place, London, S.W.3. Illustrated. Price 15s.

SO often one meets somebody in the aircraft business who soon becomes an inspiring friend or a staunch ally; then, as time passes, touch is lost and very soon one can scarcely remember even the main points of his or her character. By writing *Men with Wings* "Sandy" Powell has carefully avoided such a loss. He has recorded short biographies of eight test pilots he knows, or has known, so that the pleasure which he experienced through meeting them is passed on to those less fortunate. The book is a vivid record of the way these test pilots lived, and of their attitude to their work. It does not glamourize them; they are ordinary men with, for the most part, ordinary jobs—but every now and then there is an "incident" which would scare most other people. A.C.B.

OTHER BOOKS RECEIVED

Perspective Drawing, by Peter Manktelow. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 30s.

Ark Royal 1939-1941, by William Jameson. Rupert Hart-Davis, Ltd., Soho Square, London, W.1. Price 30s.

Glass Reinforced Plastics, edited by Phillip Morgan. Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 45s.

Indian Skyways Aviation Directory of Asia, 1957. Aeronautical Publications of India Private, Ltd., Gandhigram Road, Juhu, Bombay 23. Price Rupees 12.50.

The Air, by Edgar B. Schieldrop. Hutchinson and Co., 178-202 Great Portland Street, London, W.1. Price 30s.

Instrumentation in Testing Aircraft, by C. N. Jaques. Chapman and Hall, Ltd., 37 Essex Street, London, W.C.2. Price 45s.

Against the Sun, by Edward Lanchbery. Pan Books, Ltd., 8 Headfort Place, London, S.W.1. Price 2s 6d.

Under My Wings, by Capt. Basil L. Rowe. W. H. Allen and Co., Ltd., 43 Essex Street, London, W.C.2. Price 16s.

Aerodynamic Components of Aircraft at High Speeds, edited by A. F. Donovan and H. R. Lawrence. Oxford University Press, Amen House, Warwick Square, London, E.C.4. Price 120s.

Flynn's Flying Doctors, by Harry Hudson and P. R. Stephenson. William Heinemann, 99 Great Russell Street, London, W.C.1. Price 25s.

Aerei degli Stati Uniti, by G. Bignozzi and A. Salvati. Edizioni Cielo, Via Varese 5, Rome, Italy.

Guide to Broadcasting Stations 1957-58. Compiled by the staff of "Wireless World." Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 2s 6d.

No Mercy in the Sky, by John Fores. Hodder and Stoughton, Ltd., 1 St. Paul's House, Warwick Square, London, E.C.4. Price 15s.

Flight Today (4th edition), by J. L. Nayler and E. Ower. Oxford University Press, Amen House, Warwick Square, London, E.C.4. Price 12s 6d.

Sell's British Aviation, 1957. Business Dictionaries, Ltd., St. Dunstans House, 133-137 Fetter Lane, London, E.C.4. Price 30s.

Jet, The Story of a Pioneer, by Sir Frank Whittle. Pan Books, Ltd., 8 Headfort Place, London, S.W.1. Price 3s 6d.

Squadron Airborne, by Elleston Trevor. Pan Books, Ltd., 8 Headfort Place, London, S.W.1. Price 2s 6d.

Rescue! by Elliott Arnold. Victor Gollancz, Ltd., 14 Henrietta Street, London, W.C.2. Price 18s.

THE INDUSTRY

Vacuum-melted Steel

YESTERDAY, October 3, an inaugural ceremony was taking place in Sheffield, where Sir Frederick Pickworth, the Master Cutler (and chairman of the English Steel Corporation) was due to open the new high-vacuum melting department of G. L. Willan, Ltd., at Sussex Street.

The company, a comparatively small one incorporated in 1952, specializes in the production of high-quality steel, particularly for the aircraft industry, in which connection A.I.D. approval was given in 1954. Some eighteen months ago it was decided to investigate the possibilities of the vacuum melting process. Early last year work started on the installation of 50 kW 56 lb-capacity equipment made by the EFCO-Edwards Vacuum Metallurgical Co., Ltd., and a new 40ft span × 75ft long building was erected to house it. Preliminary melting trials were made last summer.

The aim, it is stated, is to use the new plant as a production unit rather than for research, and orders have already been received from a number of aircraft firms.

Heenan Japanese Order

AN order has been placed by the National Aeronautical Research Laboratory of Tokyo with Heenan and Froude, Ltd., Worcester Engineering Works, Worcester, for a Heenan dynamatic dynamometer designed to absorb 5,000 b.h.p. at speeds between 5,000 and 10,000 r.p.m. It is to be used for research and development work on gas turbines, and the design allows for a similar machine to be added in tandem at a later date. The type ordered operates on the Heenan dynamatic eddy-current principle control of load and speed being achieved electronically.

Bristol Aircraft Appointment

IN a news-item last week, brief reference was made to the appointment of Mr. P. E. G. Bates as commercial manager of Bristol Aircraft, Ltd., in succession to Mr. F. E. Davey.

Mr. Davey, who has held the post for 15 years, is for the time being to remain with the company in an advisory capacity. He joined the Bristol Aeroplane Co. (as it was then) in 1910, only four months after its formation. From 1914 to 1940 he served in the specifications department, being responsible for liaison between the management and the works and also for the preparation of aircraft material requirements. Then after two years as assistant commercial manager, Mr. Davey was appointed commercial manager in 1943.

Mr. P. E. G. Bates.

Mr. F. E. Davey.

Mr. Bates, who succeeds him, was in the Colonial Administrative Service after the war, leaving in 1954 to join the aero-engine division of Rolls-Royce, Ltd. From there he went to Bristol Aircraft in March this year. In his new post he will be responsible for the company's commercial and contractual activities.

Peter King Leaving Bristol

PUBLIC Relations Officer to the Bristol Aeroplane Company since 1954, Mr. Peter King is leaving to take up a new appointment as general manager of Crop Culture (Aerial), Ltd., and its associated company Britten-Norman, Ltd.

Crop Culture was formed in 1954 to specialize in the application of chemical treatments by air. Its fleet of 14 aircraft is equipped for aerial spraying and top dressing, and operations have been undertaken in the United Kingdom, the Sudan and in French and British West Africa. In the Sudan last year, the company sprayed 65,000 acres of cotton in five weeks. Work completed this year includes 150,000 acres, out of a total of a quarter of a million, on banana crops, and about 12,000 acres of treatment on various farms in the United Kingdom.

Britten-Norman, Ltd., are engaged in the design and manufacture of agricultural aviation equipment, mainly for export. In addition, they manage Bembridge Airport, I.o.W., which is the headquarters and engineering base of both companies.

Before going to Bristol, Mr. King was with the Society of British Aircraft Constructors. He was an Exhibitioner of Jesus College, Cambridge, and served with the Royal Air Force from 1943 to 1947.

D.H. Propellers Changes

UNDER a reorganization of the sales division at de Havilland Propellers, Ltd., referred to briefly in last week's issue, Mr. J. A. Airey has been appointed sales manager, guided weapons; Mr. J. B. Waite has now joined the company as technical sales liaison officer, guided weapons; and there have been two other new appointments, Mr. P. Brett becoming sales manager, propellers and associated equipment, and Mr. G. K. Webb being appointed administration manager, sales division. A.V-M. F. W. Long will continue to act as liaison officer.

Mr. Airey, who will be responsible for co-ordinating the sales effort for Firestreak, both at home and overseas, was formerly the company's chief dynamics engineer. Mr. Waite has joined D.H. Propellers from D. Napier and Son, Ltd., where for the last six years—having been with that company since 1942—he was sales manager, aero engines. Mr. Brett has been chief project engineer at D.H. Propellers for the past two years; and Mr. Webb was formerly chief sales engineer.

All these new appointments have been made under Mr. C. R. Burgess, sales director of de Havilland Propellers, Ltd.

Mr. Cyril Waine

UNTIL his death in a recent helicopter accident at East Stratton, Hants (as recorded in our issue for September 20), Mr. Cyril Waine had been with Alvis, Ltd., for more than twenty years, most of it spent in the development and servicing of the company's aero engines. He helped to build the prototype Leonides, being responsible for installing and maintaining the first one in the Bristol Bulldog; and during the Second World War he was engaged in planning the repair of Rolls-Royce Kestrels and Merlins at the dispersal factories of Alvis, Ltd. After the war he returned to Coventry and was a founder of the aero engine service department, for which he had since worked as advisory engineer.

IN BRIEF

Automotive Products Associated, Ltd., announced recently "with the greatest regret" the death after a long illness of Mr. J. K. Simpson, chief engineer and executive director of the Lockheed Hydraulic Brake Co., Ltd., and associated companies.

* * *

A memorial service was held at Chelsea parish church of St. Luke on September 24 for Mr. S. C. H. Roberts, A.M.I.Mech.E., F.I.M.I., A.I.B.A.E., chairman and founder of the College of Aeronautical and Automobile Engineering, Chelsea, and of the British School of Motoring, and J. Caryton, Ltd., who died on September 3 at the age of 68.

* * *

Aero Research, Ltd., Duxford, Cambs, have published an informative illustrated booklet, *Araldite Resins for Tooling*, describing the applications of Araldite epoxy resins as tooling materials.

* * *

Referring to their trade-marks "Cocoon" and "Texikoon," mentioned in our Farnborough Show Report, R. A. Brand and Co., Ltd., emphasize the "k" spelling of the latter name.

* * *

Technical information is now available on new high-temperature cements marketed under the trade name "Brimor" by the Morgan Crucible Co., Ltd., Battersea Church Road, Battersea, London, S.W.11.

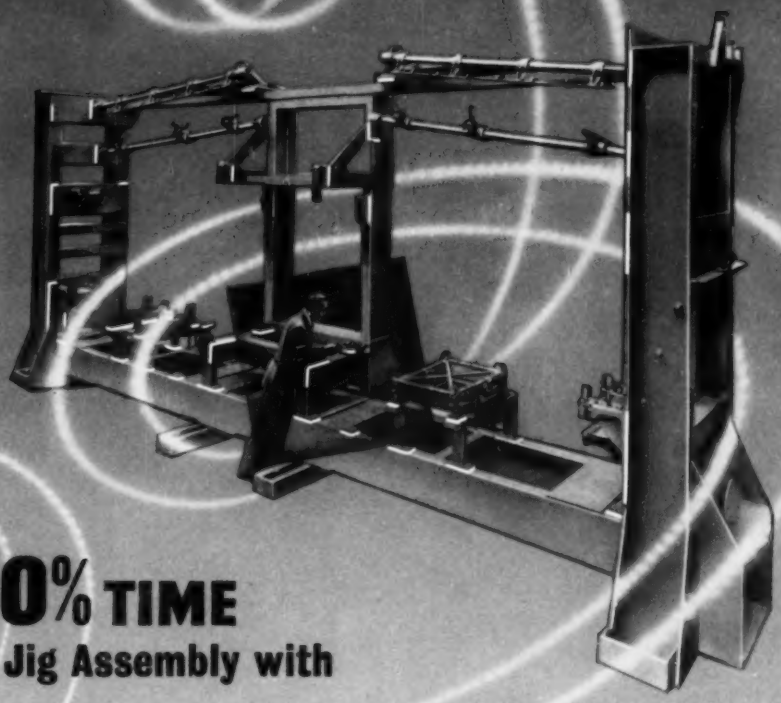
* * *

The year book just issued by Teddington Aircraft Controls, Ltd., Merthyr Tydfil, South Wales, provides comprehensive and up-to-date technical data on equipment designed and manufactured by the company; in appearance and content it forms a model for such publications.

* * *

Mr. W. McLelland, since 1945 foundry manager at the Blackheath works of Firth-Vickers Stainless Steels, Ltd., has been appointed area sales manager (Scotland and North-East England) by A.P.V.-Paramount, Ltd., of Crawley, stainless and alloy steel founders. He will also act in a technical advisory capacity in this new appointment, which he takes up on October 1.

JIGS - in Double Quick Time!



SAVE 40% TIME
on Aircraft Jig Assembly with

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LOW TEMPERATURE-MELTING EXPANDING ALLOY

Reduction of over 40% in time spent on machining and fitting; machined surfaces are completely eliminated—the surface is, in fact, brought to the job and created to match the job. In addition, unnecessary measurements are cut out, and jig boring is greatly facilitated. Rigidity—jigs constructed by this method have given five years' service without trouble. Perfect accuracy—brackets can be removed and replaced "spot on". Lower cost—tooling costs as compared with the older methods of jig building are reduced out of all proportion.

A. V. ROE & Co. Ltd., to whom we are indebted for this information, consider that no return to the old methods could be entertained, as the cost would be absolutely prohibitive.

Full details sent on request

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SAFETY

The reflex action which calls up the hedgehog's defences at the threat of danger is not so certain, not so swift as the automatic change-over of Boulton Paul Power Control Units to reserve power circuits when one of a pair of duplicated units is damaged. Boulton Paul power units, too, bristle with good points—they are sensitive, accurate, stable, reliable and safe.

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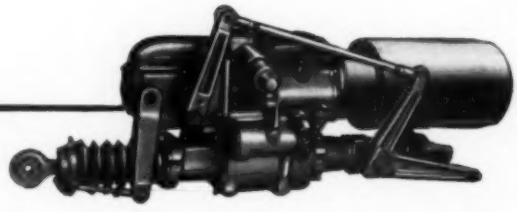


J2992

Royal Swedish Navy Orders Vertol 44's

A special committee of the Swedish Navy made a year-long study of helicopters suitable for anti-submarine warfare as well as utility transportation. In the United States they consulted with headquarters personnel of the three armed services, visited helicopter manufacturers and toured military operating units.

At the conclusion of this intensive study, the Swedish Navy placed an initial order for four of the 22-place Vertol 44's, to be augmented later by additional procurement.

Official Navy announcement of the purchase said the choice was mainly based upon the Vertol 44's "good stability in hovering and towing missions, good instrument flight capabilities and mission endurance . . . practically unlimited controllability for the contemplated missions."

Sweden thus became the fifth western nation to purchase the sturdy Work Horse helicopter, first choice of the experts for the most difficult assignments.

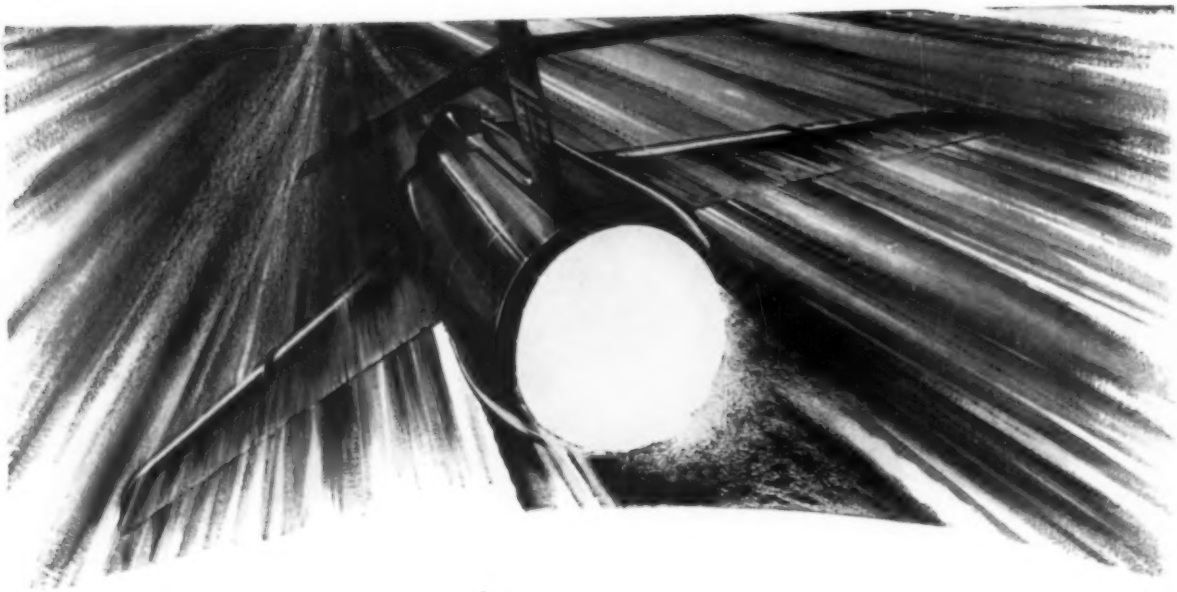
In commercial or military use the Vertol 44 offers these features:

- Highest useful load, largest seating capacity
- Lowest seat mile cost
- Automatic stabilization
- Instrument flight capability

For detailed information write: Customer Relations Manager

VERTOL Aircraft Corporation

MORTON, PENNSYLVANIA



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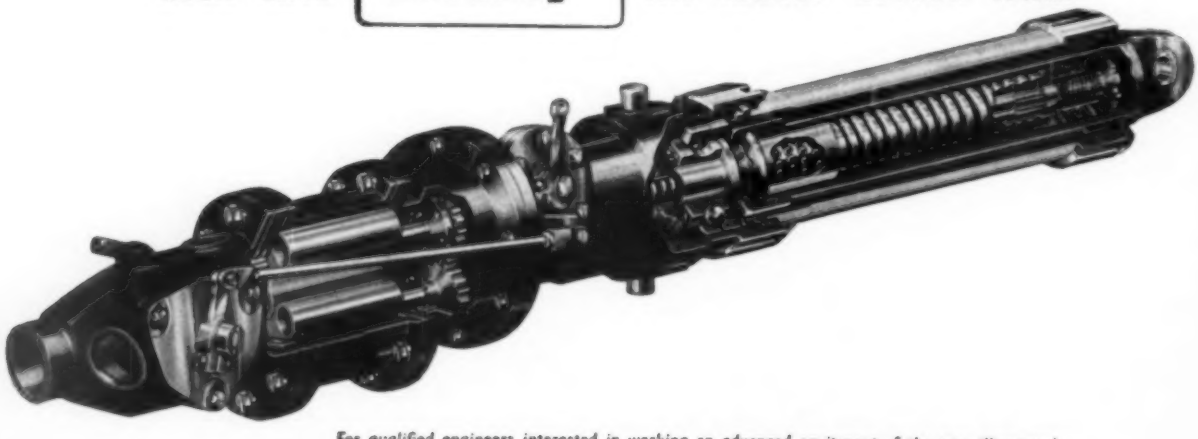
A wide range of Plessey Air-Motor powered rams is under development for contemporary aircraft. These have other applications such as Thrust Reversal and Thrust Deflection systems.

* 0.5 to 0.7 seconds for full stroke depending upon altitude.

with this Plessey Air-Motor driven Ram



For qualified engineers interested in working on advanced equipment of the type illustrated the opportunities at Plessey are outstanding. Write to the Personnel Officer for information.

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A78

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

The R.A.F.'s Future

SPEAKING on *The Future of the R.A.F.* at a meeting of the R.Ae.S. Graduates' and Students' Section on September 26, the Under-Secretary of State for Air, Mr. Charles Orr-Ewing, said that the R.A.F. received 34.3 per cent of the total defence expenditure, the Army 28.2 and the Royal Navy 22.2 This figure for the R.A.F. was reassuring and related to the Government's decision that the "nuclear deterrent" was the main force by which any future war might be prevented.

To date, deterrent power in this country had lain in the hands of the U.S. Strategic Air Command, but it was now passing to the V-bombers and Canberras of Bomber Command. When a potential threat changed from manned bombers (which could be countered by manned fighters) to IRBMs as well, it would be necessary to use such "extreme techniques" as dispersing the deterrent force overseas, keeping some aircraft continually in the air (as is done by the S.A.C.) or "scrambling" V-bombers after a warning of ballistic missiles had been received.

Vulcan to Vesuvius

AN Avro Vulcan flew from Waddington to Naples—a distance of 1,121 miles—in one hour 50 minutes on September 23 at an average speed of 615 m.p.h. It was captained by W/C. F. L. Dodd with the A.O.C-in-C. Bomber Command, Air Chief Marshal Sir Harry Broadhurst, as co-pilot.

The Vulcan left Waddington at 2.40 p.m. and arrived over Capodichino Airfield at 4.30 p.m., landing there at 4.37 p.m. W/C. Dodd commands No. 230 Operational Conversion Unit, the work of which was described in *Flight* last week (pages 502-505).

Senior Medical Appointment

APPOINTED Principal Medical Officer at Home Command as from October 22, with the acting rank of air vice-marshal, A. Cdre. James Hill has been P.M.O. at Technical Training Command since 1954 and prior to that held a similar appointment with Coastal Command.

He joined the R.A.F. in 1927 after graduating from Glasgow University and training at Glasgow Western Infirmary. Prior to the war he served in the Middle and Far East and during it was S.M.O. at No. 5 Group, Bomber Command, before joining the Directorate of Medical Services at Air Ministry and later (1943-45) serving again in the Far East, as Air Medical Adviser to the Supreme Commander, S.E. Asia. Mentioned in dispatches in 1941 and 1942, he was appointed C.B.E. in 1957.

Comets' Atlantic Crossing

TWO Comet 2s of No. 216 Squadron, Transport Command, flew the Atlantic non-stop from east to west on September 25. The first took off from Aldergrove at 0245 G.M.T. and landed at Gander, Newfoundland, at 0811; the second, airborne exactly an hour later, landed at Gander at 0909. Both aircraft were on their way to Pinecastle A.F.B., Fla, carrying ground crews to service the Bomber Command Vulcans and Valiants taking part in the Strategic Air Command bombing competition later this month.

R.N.A.S. and H.P. Reunion

THIS year's annual dinner of Nos. 7 and 14 R.N.A.S. Squadrons and the R.A.F. Handley Page Squadrons' Association will be held at the Horse Shoe Hotel, Tottenham Court Road, London, on October 12, at 6.30 for 7 p.m. Those interested should contact the hon. secretary, G. Conley, 62 Nightingale Lane, London, S.W.12 (tel. Battersea 6173).

IN BRIEF

R.A.F. Aldergrove is to be presented tomorrow, October 5, with the freedom of Belfast.

* * * * *

At R.A.F. Medmenham last Friday the final of No. 90 Group catering competition was won by R.A.F. Digby. Medmenham was second, Norton (Sheffield) third and Watton fourth.

* * * * *

Valiants and Shackletons from Malta have been taking part in the NATO exercise "Deepwater," which began on September 24 (and is referred to in a news-item on page 530).

* * * * *

An award of £500 has been made on the authority of the Air Council to Off/Cdt. Victor Rose for devising an inspection lamp which permits checks of Derwent diffuser rings without the engine having to be stripped. He made the prototype lamp last year when a flight sergeant at No. 60 M.U., Rufforth.

Air Chief Marshal Sir Douglas Evill, who commanded No. 202 Sqn. in 1916 (when it was No. 2 Sqn., R.N.A.S.), inspecting the parade at R.A.F. Aldergrove on September 6 when he presented a standard to No. 202.

The C.A.S., Air Chief Marshal Sir Dermot Boyle, who on the Queen's behalf presented his personal clerk, F/Sgt. J. Morrison, with the B.E.M. at Air Ministry recently, congratulates him after the ceremony.

W/C. R. G. W. Oakley (who commands No. 138 Sqn.) is seen to the right with W/C. A. D. Frank (C.O. of No. 83 Sqn.) and Maj. D. Clark (centre), captain of one of the B-47s against which their Valiants and Vulcans will be competing in the S.A.C. bombing contest at Pinecastle A.F.B., Fla. Below, three captains of the Vulcans in the Bomber Command team enjoying a less arduous form of competition. From left to right, W/C. A. D. Frank, S/L. D. R. Howard and W/C. C. C. Calder.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

The striking three-engined model referred to below by Mr. Michael A. Shepherd.

Neglected Veterans?

IT is not so very long since I, in common with many hundreds of others, heaved a sigh of relief at the retention in this country of the early aeroplanes of the Nash collection: it will be remembered that the Royal Aeronautical Society saved them from going to America.

I saw them at Wisley on September 15, the occasion of the Society's Garden Party, and I was appalled and angered at the pathetic condition in which these venerable aircraft now are. They have deteriorated markedly since I saw them at Farnborough in 1955 and now bear much the same relationship to aeroplanes as scarecrows do to human beings. I was left with the feeling that it would have been far kinder not to have exhibited them—indeed it might have been better if the poor old things *had* gone to America, for there they might have been made, if not airworthy, at least presentable.

Most lamentable of all was the Avro 504K, H.2311. Only five or six years ago this elegant veteran was flying, but at Wisley the odd flying wire was missing and H.2311 had every appearance of being grounded for good.

The Camel had apparently had something more substantial than the proverbial straw dropped on it: the trailing portion of its centre section was broken and there was a sizeable dent in the turtle-back just behind the cockpit. This aircraft and the S.E.5a, two of the immortals of the Kaiser's war, both looked as if a swarm of souvenir-hunters had gone over them.

The Fokker D.VII was possibly the most presentable of all the veterans, but the Bleriot XXVII looked as if it had been pulled through several hedges sideways. (Moreover, I can testify that it left Wisley in even poorer condition than it arrived—a sturdy schoolboy leaned most of his weight on the trailing edge of the starboard wing beside the cockpit, and the wing protested audibly.)

The less said about the Caudron and Farman the better, but I am haunted by the memory of the Heath Robinson repairs to the Caudron's tail-booms and the Emett-like method of using bootlaces (?) to hold the wing fabric in place.

One would have expected that, of all bodies, the Royal Aeronautical Society would have appreciated the value of these historic machines and would have known how to look after them. The fact that we have no national aeronautical museum only adds point to the matter.

Or does no one—no one at all—care?

Birmingham. ICHABOD.

The Technician and his Status

WHAT a pity that the picture of technicians queueing up to clock on with knife, fork, spoon and mug in one hand and a slide rule in the other evokes from Capt. J. Laurence Pritchard nothing more than a contemptuous smile and an urge to break into pointless parody; and that the absence of a few meaningless names blinds him to the fact that all is not well on the technical side of the aircraft industry.

In these days when so much lip-service is being paid to the necessity of training more and more technicians it is unfortunate that few, if any, people stop to ask what these much-wanted technicians are going to be offered if and when they do arrive in the industry.

They will be offered, without a doubt, jobs of responsibility (for men willing to take responsibility are hard to find today); jobs which will require every atom of technical ability even to maintain, let alone improve, Britain's position in the sphere of aircraft commerce; jobs upon which may ultimately hang the economic survival of many aircraft firms; jobs upon which will depend the very lives of countless pilots and passengers. And along with the responsibility what else is offered?

Status and conditions equivalent to those enjoyed by qualified members of other professions? "Twelve Aircraft Technicians" have already answered that one. The respect normally accorded to those in positions of responsibility? Capt. Pritchard has answered that one. A salary commensurate with their responsibility? The exodus of technicians from the industry has answered that one.

These are questions which are at present causing concern amongst aircraft technicians: they are questions which, sooner or later, must be faced by the remainder of the industry. In the meantime no useful purpose is served by pouring scorn upon those who attempt to bring the matter out into the open. Is it asking too much for at least *some* constructive comments?

Since I am not one of those who take any delight in seeing their names in print, may I sign myself

ANOTHER AIRCRAFT TECHNICIAN.

IF "Twelve Aircraft Technicians" think they'll better their professional status by crossing the Atlantic, they are in for a sad surprise. They talk about being "slaves of the time-clock"; well, out here they would "clock-on" with the rest. And how lucky they are to *have* a canteen! In my firm food is brought round by mobile food-vending machines, and you eat it at your desk, with disposable plastic knives and forks. Delightful! And "the twelve" have a tea-break, too. There is no tea-break at my firm, but the management allows you to bring your own flask and drink it when you can.

My advice to your correspondents is: stay home, you don't know when you are well-off. You can stand around and talk for half-an-hour after the tea-break in the U.K. and you don't get any insulting remarks about Britain and Limeys. So, hang on to the "emerald set in a silver sea," chaps! You've never had it so good. I'll be joining you in a few weeks. Thousands may be leaving the U.K., but there is always a steady trickle back.

Canada. LIMEY STRESSMAN.

New Shapes in Airliners

WITH reference to the article "The Short-range Jet Airliner" by J. M. Ramsden in *Flight* dated September 6, I would like to point out that the sketch of the "three-engined tail-first airliner" at the foot of page 384 would appear to be an exact copy of a model long-range airliner designed, built and exhibited by me at the recent Model Engineer Exhibition at the New Horticultural Hall, Westminster, London.

I would be interested to know if your artist went to the Exhibition, or whether, by some strange coincidence, his ideas and mine have arrived at the same conclusion. I am enclosing a photograph of the model [reproduced above].

Ashtead, Surrey. MICHAEL A. SHEPHERD.

[The drawing was based upon two *Flight* sketches originally published in our February 8 issue, "Supersonic Air Transport," page 176.—Ed.]

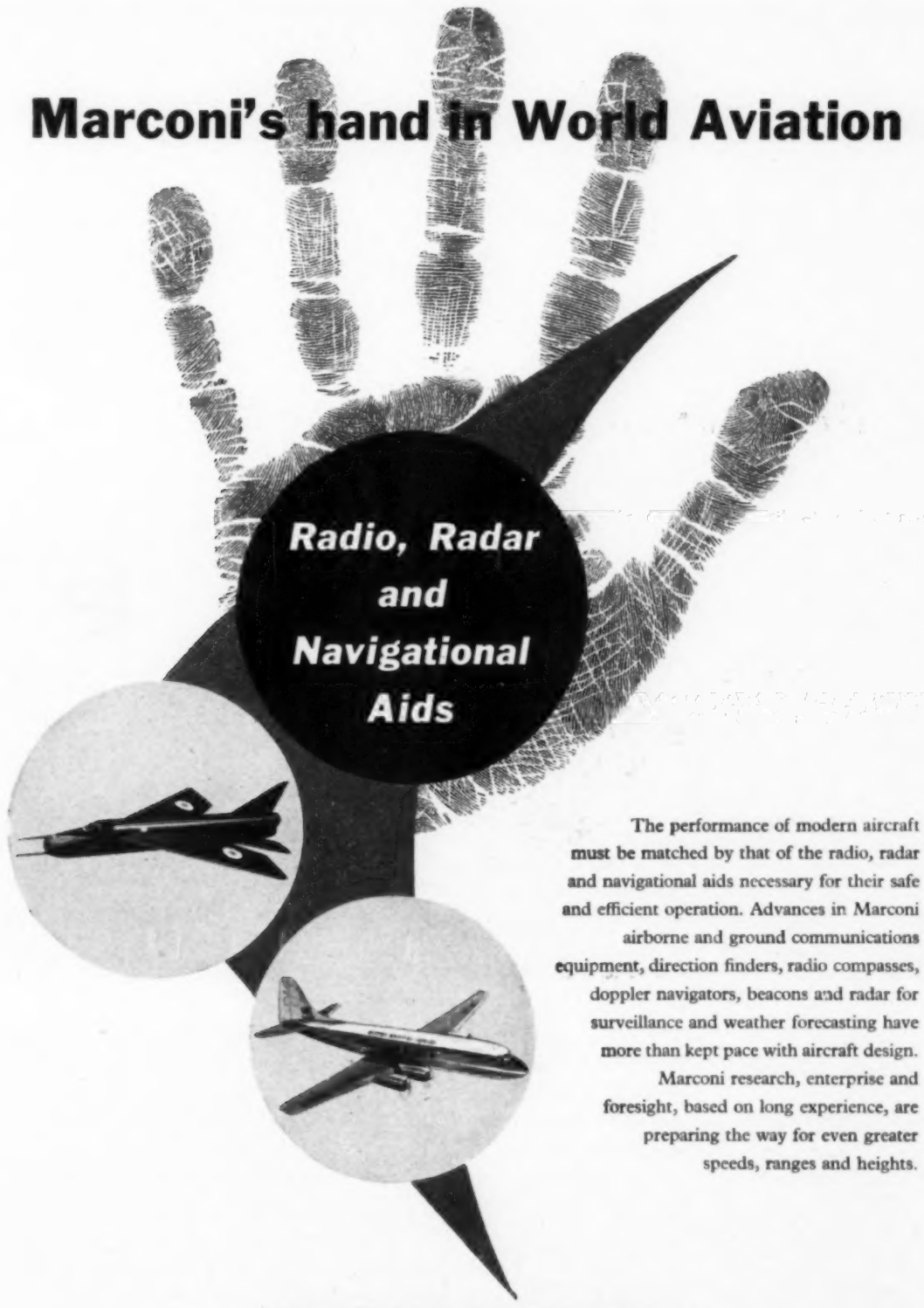
FORTHCOMING EVENTS

Oct.	4.	Helicopter Association: "Tilt Wing Aircraft in Comparison with Other VTOL and STOL Systems," by W. Z. Stepniewski, Dipl.Ing., A.F.I.Ae.S.
Oct.	8.	R.Ae.S.: Section Lecture: "Some Thoughts on Non-Linear Problems in Aerodynamics," by P. J. Duncton.
Oct.	9.	Kronfeld Club: "Formation Aerobatics," by S/L. Topp.
Oct.	11.	Tiger Club: Annual Dinner, R.A.F. Club.
Oct.	16.	G.A.P.A.N.: Annual General Meeting.
Oct.	16.	R.Ae.S.: Graduates and Students Section: "Trends in Air Transport," by P. W. Brooks, B.Sc. (Eng.), A.C.G.I., A.F.R.Ae.S.
Oct.	16.	Kronfeld Club: Film Show given by Betsy Woodward.
Oct.	16.	G.A.P.A.N.: Annual general meeting.
Oct.	22.	R.Ae.S.: Section Lecture: "Aircraft Instrumentation for Flight-test Purposes," by R. I. Duddy and I. McLaren.
Oct.	23.	Kronfeld Club: "Trailer Building," by Tony Goodhart.
Oct.	30.	Kronfeld Club: "B.E.A.," by P. W. Brooks, B.Sc.(Eng.), A.C.G.I., A.F.R.Ae.S.
Oct.	31.	G.A.P.A.N.: "British Aircraft: Some Designers' Problems," by D. L. Brown, A.M.I.C.E., M.I.Mech.E., M.I.Gas.E., A.F.R.Ae.S.
Nov.	2.	British Interplanetary Society: "Conditions for Life," by Dr. J. W. S. Pringle, M.B.E., F.R.S.
Nov.	7.	R.Ae.S.: Graduates and Students Section: "Background to Aircraft Specifications," by K. W. Clark.
Nov.	13.	Royal United Service Institution: "The Aircraft Designer's Dilemma," by Dr. G. V. Lachmann, F.R.Ae.S.

R.Ae.S. Branch Lectures (to Nov. 13):—

Oct. 8, *London Airport*, "Some Aspects of the Development of the Fokker Friendship," by H. Van Meerten; *Luton*, "Human Limitations of High Performance Flight," by S/L. T. C. D. Whiteside. Oct. 29, *Bascombe Down*, "Review of the Future Prospects of Fleet Aviation," by Capt. D. R. F. Campbell. Nov. 13, *London Airport*, Brains Trust.

Marconi's hand in World Aviation



The performance of modern aircraft must be matched by that of the radio, radar and navigational aids necessary for their safe and efficient operation. Advances in Marconi airborne and ground communications equipment, direction finders, radio compasses, doppler navigators, beacons and radar for surveillance and weather forecasting have more than kept pace with aircraft design. Marconi research, enterprise and foresight, based on long experience, are preparing the way for even greater speeds, ranges and heights.

MARCONI

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX, ENGLAND

LG 22

Viscounts succeed in the outback

Mr. Arthur Butler, of Butler Air Transport, said recently: 'My Company have been operating our Viscount 747 aircraft for nearly two years. It is fitting, therefore, that I should express my appreciation and admiration of these wonderful aircraft which have brought a standard of travel, equal to the world's best, to the outback people we serve. They are continuing, day by day, to attract more traffic.'

The maintenance man's problems have always been very much in the minds of the Viscount design team. Advances made in the aircraft during its continuous evolution have resulted from operational needs and from discussion with the men responsible for keeping the Viscounts at the peak of performance. Viscounts are now backed by the ten years' propeller-turbine experience of Vickers and Rolls-Royce. In the latest version — the Viscount 810/840 — this means an aircraft that is more accessible for maintenance, easier to memorise, cleaner to work on and more rapidly serviced. Result — faster turnround, lower overheads and aeroplanes where they should be — in the air and earning profits.

There is no substitute for experience

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CIVIL AVIATION

Northeast Postpone Their Britannia Plans

THE decision of Northeast Airlines to postpone for a year their programme to introduce five Britannia 305s raises a number of confused issues, some of which may only be fully understood when they can be viewed in the perspective of time. Northeast's decision was announced simultaneously, and with complete surprise, in London and New York last Friday evening.

Northeast ordered the five 305s (released for the purpose by B.O.A.C., who subsequently replaced them with five more 312s) on December 3, 1956. Northeast had just been awarded traffic rights to the lucrative Florida holiday area, and the contract with Bristol required that the Britannias should be delivered in time for the Christmas season—i.e., by October. The U.S. airline saw in the Britannia a means of capturing from its rivals (mainly Eastern) the heavy luxury-class holiday traffic.

When it became apparent that the delivery schedule had failen back eight weeks (originally three aircraft were to be delivered this month and the remaining two in November) Northeast felt that what they had called the "sex-appeal value" of introducing the Britannia had been lost: first-class traffic to Miami out of season is thin, and Northeast did not want to introduce Britannias on coach-class flights.

The reason given for the eight-week delay is that the 114 modifications required by the U.S. Civil Aeronautics Administration could not be completed by the certification target-date of October 1—though Bristol are at pains to point out that they have no quarrel with the C.A.A. It is not clear what view the C.A.A. have taken of the engine icing problem which, until the adverse B.O.A.C. publicity on September 9, they believed to have been resolved; the C.A.A. have apparently not been influenced on this score by the issue on September 19 of the 312's British C. of A. containing its advisory proviso. But there was little discussion of engine icing at the Press conference held by Bristol in London last Friday, and Sir Reginald Verdon Smith stressed that it had had no influence on the latest turn of Britannia events.

The chairman of B.O.A.C., Mr. Gerard d'Erlanger, who was present at the Press conference, said that the Corporation "had suggested to Bristol that B.O.A.C. should examine the practicability of using the aircraft until they are taken over by Northeast." It may be asked how this can be reconciled with the recent efforts to find 15 Britannias for delivery to T.W.A., and with the understanding that B.O.A.C. are prepared to defer four Britannias to help make up this number. Assuming that T.W.A.'s Britannia interest remains keen (Mr. Peter Masefield said in New York on September 28 that the deal was still "pretty hot"), the conclusion can only be that the five ex-Northeast 305s would be ready for T.W.A. too soon. The aircraft, built by Short's at Belfast and finished at Filton, are now due for completion in January and February. (The first 305 flew on June 1.)

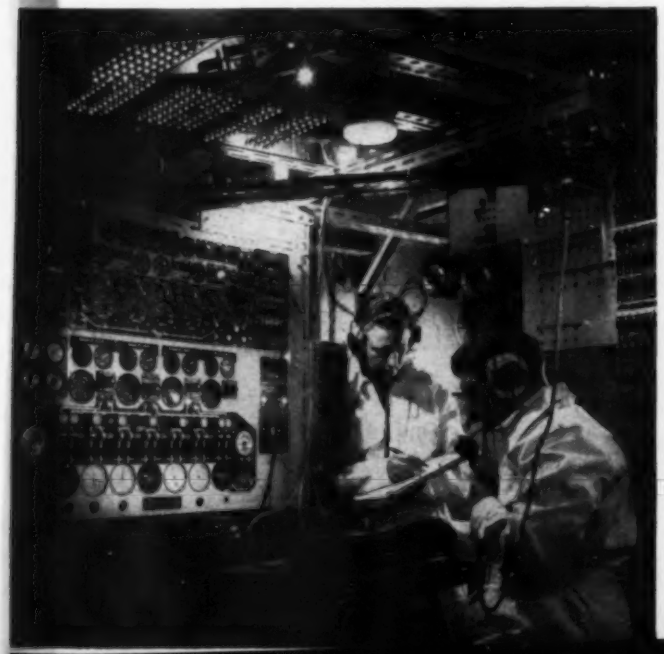
B.O.A.C. are now having to consider the extent to which the Northeast 305s will have to be re-modified to suit the Corporation's requirements. If the aircraft are eventually to go to Northeast, clearly any B.O.A.C. changes will have to be small. The cockpit layout, which is designed to U.S. standards for American domestic operation, might well require alteration for B.O.A.C. use: the main differences are the inclusion of a flight engineer's station, and the deletion of the navigator's station. Most of the differences in equipment will no doubt be tolerated: these include the American flight instrumentation. Structurally, the 305 differs from the 312 in that its extension-wing fuel tanks are bag-type and not integral (total tankage, and therefore range, is about the same); and that fuselage skin thickness is slightly less, reducing cabin pressure differential from 8.5 to 7.2. The Northeast cabin interior, a highly contemporary piece of Charles Butler styling, has not so far been installed in the 305s, and this should not therefore be a problem to B.O.A.C.

The 114 C.A.A. modifications were mainly minor, and not particularly related to turbine requirements. The 305 was, of course, designed and built to A.R.B. standards, and the changes to make it adhere to the U.S. code were begun only when the Northeast order was placed last December. The important changes were to the main undercarriage gear, which had to be strengthened to permit pivoting about one bogie; to the fire-extinguishing system; and to the shape of the emergency exits.

Northeast have stressed that their Britannia order has merely been postponed—although the contract will, it is understood, have to be re-negotiated. Certainly Northeast will need competitive aircraft for Christmas 1958, by which time Eastern are due to have the first of their 40 Lockheed Electras in service.

B.E.A. HERON ACCIDENT

THREE lives were lost last Saturday when the B.E.A. Heron ambulance G-AOFY, crashed while on its way from Renfrew to the Isle of Islay to take a sick woman to hospital in Glasgow. It was last seen coming in to land in bad weather, with low clouds. "The pilot . . . turned to starboard to do his procedure turn," commented Mr. R. McKean, B.E.A.'s manager in Scotland, "then disappeared and all radio contact was lost." An hour later, the wreckage of the Heron was located less than a mile from Islay's airport at Port Ellen. None of the crew (Capt. T. M. Calderwood and R/Off. Hugh McGinlay, with Nursing Sister Jane Kennedy) survived. The accident was the first since the Scottish air ambulance service began more than 20 years ago.



Part of the pre-certification ground testing of the Comet 4 and 4B is simulated loading of the electrical system, here being checked on a rig at Hatfield. On the left is the flight engineer's panel, with electrical systems at the top, fuel and cabin air services below.

SILVER CITY REDUCE FARES

THAT ferrying cars across the Channel by air has proved so popular has previously been less a matter of minimum fare than of speed and convenience; but, since October 1, Silver City have reduced some of their charges for vehicles to below the comparable fare by sea. During the six winter months, the cross-channel ferry business falls-off sharply and overhead costs rise; the corollary is that summer earnings must offset winter losses. Silver City hope that the new rates, by reducing vehicle transport charges to about the level of those by sea, will attract more winter business from the 25,000 cars that cross the Channel during this season. If they succeed in doing so, consideration will be given to introducing low summer fares as well.

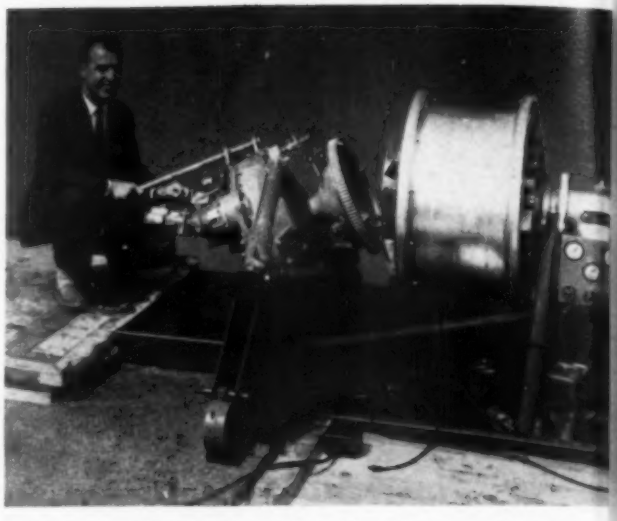
The new single air fare (at company's risk) for cars less than 11ft long is now £3 10s, and compares with the previous fare of £6 10s and the boat fare (at company's risk) of £4. For cars 15ft long, the air fare is £9 10s and the boat fare £9.

TEGUCIGALPA F.I.R.

ON October 21, six Central American nations—Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala and British Honduras—will establish a common Central American Flight Information Region. The problem of multiple F.I.R.s in the region was thrashed out by the Central American States at the I.C.A.O. Caribbean Regional Meeting in Ciudad Trujillo last year, and the idea of a combined region, unhampered by the effects of national boundaries, was adopted as part of the I.C.A.O. plan for the Caribbean Region. Tegucigalpa in Honduras is to be the co-ordinating centre.

In Montreal on October 7 the I.C.A.O. European-Mediterranean committee are meeting to discuss the possibility of similar integration for air traffic control systems in the EuMed region.

A. Cdre. G. J. Powell, who, as announced below, is to retire from British Aviation Services.



The Consolidated Diesel Electric hydraulically driven wheel power unit for jet transports (see news item on opposite page) is here being fitted for demonstration purposes into the wheel of a B-52. The prime mover is contained within a truck attached to the wheel unit with a rigid bar.

CIVIL AVIATION . . .

A. CDRE. POWELL TO RETIRE

BRITISH Aviation Services announced last week that A. Cdre. Griffith J. Powell, C.B.E., managing director of B.A.S., is to retire on medical advice. He expects to leave England at about the end of the year and will then live abroad—probably in the West Indies. A statement by Mr. Eoin C. Mekie, B.A.S. chairman, says: "It is our hope that after a period of recuperation we will be able to welcome the return of the Air Commodore to an active rôle in the Group which he has served with such distinction."

In addition to relinquishing his position as managing director of B.A.S., A. Cdre. Powell will be giving up similar posts with companies within the group, notably Silver City Airways, for the growth of which he has been largely responsible since the company was formed in 1946. Prior to the war—in which he served in the R.C.A.F. and as S.A.S.O. to R.A.F. Ferry Command and later to No. 45 Group—A. Cdre. Powell flew with Imperial Airways as a pilot on the Empire routes and on the Atlantic experimental flights. He was operations manager with Imperial Airways (Bermuda) from 1937 to 1939.

LIKE A HEADLESS CHICKEN

AN American Airlines DC-6A was recently involved in a freak accident at Los Angeles Airport, reports *Aviation Daily*. The No. 3 propeller, coming off just after the aircraft left the ground, cut under the belly and severed the No. 1 engine controls. The crew cut off the other engines, but No. 1 kept running and put the aircraft into a series of concentric circles. This went on for 20 minutes before firemen brought it to a halt by directing their hoses at the engine intake. Meanwhile, the crew put out a fire in the No. 3 engine and then bailed out *via* a rope ladder. The aircraft remained upright throughout, and the 17,000 lb of cargo aboard was undamaged.

STOCKHOLM'S AIRPORT PROBLEMS

IT was announced in Stockholm on September 18 that the Swedish Government had rejected the proposal to build Stockholm's new airport at Ska-Edeby. They concluded that the costs involved were much too high; recent investigations had shown that the ground conditions at Ska-Edeby were unsatisfactory; and the roads and bridges needed would be too expensive. Commenting on the Government announcement, the future president of Scandinavian Airlines System, Mr. A. Rusck (his appointment takes effect on January 1), said that his airline felt the decision was an unhappy one. According to S.A.S., the only other possible solution is an extension to 8,200ft of the main runway at Bromma Airport. This would not, however, allow DC-8s to operate at their gross weight. S.A.S. maintains that the other alternative—Halmsjö—is most unsatisfactory, and the only sensible new site would be Jordbro, which has so far been ruled out by the Swedish Air Force and the Navy for strategic reasons.

RECOMMENDATIONS FOR AIRPORT CHARGES

INTERNATIONAL airports all over the world are not paying their way; and although their economic position has improved since 1951, as a whole they are operating at a large annual deficit. This situation is obviously very unsatisfactory for the airport provider, yet no real balance has been achieved between the benefits that airports confer upon the community and the general economic situation of international air transport.

This problem has been the subject of a recent investigation by I.C.A.O., who have issued a *Statement by the Council to Contracting States on Airport Charges*. Their recommendations—as they are fully aware—must be viewed in the light of this lack of balance, but they establish the principle that ultimately airport users must pay for the facilities that are provided. Each government and airport authority must judge what proportion of the costs should be allocated to the benefit of the State and to what extent the space and facilities devoted to governmental inspections should be provided at public expense. But as a general principle, the recommendations are that where the nationals of one State use an airport provided by the nationals of another, the users should ultimately pay their full share of the cost of providing the airport and its essential ancillary services (including interest on capital, depreciation, maintenance and operation).

The statement also discusses the manner in which landing charges should be levied, and recommends a basis of maximum landing weight. In the interest of safety, this charge would include the use of lights and special radio aids, but if additional charges are made for facilities of this kind they should be uniformly imposed on all landings occurring during periods established by the airport operator.

An element of the charges could be related to the cost of general passenger facilities in the terminal building, but, say the Council, there are strong practical objections to any arrangement that involves collecting it directly from the passenger. Contracting States wishing to levy a passenger service charge should make the necessary arrangements with the airlines, so that the passengers will not be required to make separate payments.

Concerning adjustments to the charges, the Council is against discrimination in relation to the stage-length flown, except possibly for short-haul services. Exemptions or lower landing rates for non-commercial operations are viewed with favour, provided that additional financial burdens are not transferred to international air transport, and "there is special justification for fixing a lower level of landing charges for helicopters, since their use is in an early stage of development and they do not utilize many of the facilities provided for fixed-wing aircraft."

LIFESAVING EQUIPMENT ON VIEW

AN exhibition of life-saving equipment—inflatable rafts, lifejackets and associated aids—is in progress at the London offices (8 Great Tower Street, E.C.3) of Cory Brothers and Co., Ltd., who are responsible for all U.K. and overseas sales and servicing of the rescue products of Elliot Equipment, Ltd., of Llwynypia, South Wales.

The exhibition—which continues until October 25—is being staged at Great Tower Street because the two companies feel that this address is a particularly convenient one for executives of shipping companies and airlines. On view are a wide variety of rafts of both merchant-ship and aircraft types, in capacities ranging from 25 men to four. The latest types of Elliot lifejackets are also displayed.

B.E.A. AND CYPRUS AIRWAYS

POLITICAL unrest in the Middle East and a restriction of their services to those between Cyprus and Greece, Turkey and the Lebanon resulted in a deficit for Cyprus Airways of £73,151 at the end of 1956, after four years of profitable trading. The airline are now looking to B.E.A.—who, in common with B.O.A.C. have a 23 per cent holding in their stock—to extend their operating (although not, apparently, their financial) interest by taking over the majority of Cyprus Airways' routes. The Corporation already provides Viscounts under a hire agreement for certain services between Nicosia and Beirut, Nicosia and Athens, and Nicosia and Tel-Aviv as part of the joint operation of the B.E.A./Cyprus Airways London-Athens-Nicosia/Beirut/Lydda route. After protracted discussions, agreement has now been reached that B.E.A. will take over in January next year. It is understood that the Corporation will operate the routes on a charter basis.

POWER-ON, POWER-OFF

AN after-Farnborough comment in our issue of September 13 was to the effect that, in spite of much talk during the past twelve months about "clip-on" wheel units for engine-off taxying, actual hardware had yet to materialize. This may have raised a quiet chuckle from the Consolidated Diesel Electrical Company of Canada, who—although they have been working on a project of this nature for some time—released information on their "wheel power unit" only last week.

The application is largely, but by no means solely, to move civil jet aircraft up to and away from airport fingers with the engines stopped and with a consequent saving in fuel and reduction in noise. Conventional methods of doing so by tractor tugs have shortcomings in the size of tug required, traction in slippery conditions, tow-bar jack-knifing problems and the control of the aircraft under tow being passed to the tug driver. Less conventional methods—cable harnesses, tyre-on-tyre friction devices, and jacking tugs which support some of the aircraft's weight—present other problems of engineering and operational flexibility.

The wheel power unit has the advantage that, after it has been coupled to the aircraft wheels, it is under the pilot's control; and logical integration within the power unit can make use of the torque from the prime mover to provide 400 c/s A.C., 28 or 115 V D.C. electric power, high- and low-pressure air supplies and refrigeration.

The unit designed by Consolidated Diesel Electric has been developed (although orders have not so far been placed) for the Boeing 707, and schemes for the DC-8 have been studied as well. Trials with the prototype 707 are to be made this month. It is proposed that in operation the unit, consisting of a "low-silhouette" power truck, attachment bars and wheel units, should be placed at a runway staging point where a man would be stationed to fit the wheel units into place. This operation, which consists of coupling a ring gear drive (a possible pneumatic application would use an expanding brake band drive) to the starboard bogie and attaching torque reaction struts across the wheels and to the bogie on the other side, takes two minutes or less. Ground services would then be plugged in and control (*via* a 12-core cable to the throttle box in the cockpit) would pass to the pilot. With the present unit, 170,000 lb-in torque is supplied to the wheel and aircraft of 200,000 lb weight can be taxied up a five per cent gradient at five m.p.h. The throttle box is designed to allow the aircraft to be driven forward, reversed, or swivelled by driving the bogies in opposite directions. Limiting stops in the box control the minimum turning radius and the system would be coupled to the aircraft's nosewheel.

A shortcoming of this device is the time involved in attachment and release of the units; in some applications an internal A.P.U. may be preferred to serve the same function. A possible development, however, is to mount the prime-mover truck flush with the runway, effect wheel coupling automatically, and winch the truck up on to the aircraft's belly.

Consolidated Diesel Electric are negotiating the manufacture of wheel power units and other servicing equipment with firms in this country.

VISCOUNTS ON SAFARI

WHILE final plans for the start of Hunting-Clan and Airwork's Viscount Safari services are subject to the issue of a route licence and agreement with Egypt on transit arrangements at Luxor Airport, provisional plans (as foreshadowed in *Flight*, August 23) have been made for an inaugural flight this month. The first service from London would leave on October 17 and return on October 20. There would subsequently be two flights weekly in each direction and the use of Viscounts will enable the journey-time to be reduced from three days to two with a night stop at Luxor. The new services may be routed *via* Rome instead of Malta, and the possibility of a reduction in fares if Luxor is used has been mentioned.

CORK'S AIRPORT

THE future of Farmers' Cross airfield, Cork, is in the balance. Potential users and travel agents from the city are discussing with the Lord Mayor of Cork schemes enabling international services to utilize existing facilities at the airfield. The authorities in Dublin propose a new airport seven miles from Cork, to come into operation as a feeder to Dublin and Shannon in three years' time.

Sited four miles southwest of Cork, Farmers' Cross is a grass field at an elevation of 570ft (too high, say the Dublin authorities, to be of value in low cloud conditions). Its two runways are capable of extension to 4,000ft and 5,280ft respectively. Four companies, including Jersey Airlines and Cambrian Airways, are interested in operating regular services from Farmers' Cross, where the installation of I.L.S. is reported to be under consideration by the newly-formed Cork Airways Company.

WOODEN WALLS

DISTURBING news for owners of wooden aircraft, particularly those more than ten years old, is contained in an A.R.B. *Notice to Licensed Aircraft Engineers and to Owners of Civil Aircraft* No. 50, Issue 1. It has been found on recent examination that water soakage and other causes has led to decay of the timber and deterioration of the glued joints of such aircraft, particularly those built before 1947. In most cases normal inspection has not revealed the trouble, which frequently occurs in inaccessible places. Before renewing the C. of A. the Board's surveyors will now require evidence that "exceptional measures" have been taken in dismantling, opening-up and upholstery removal in order to ensure that all joints have been made good. Aircraft on approved maintenance schedules are similarly affected.

TALKING OVERHAUL SHOP

THE third quarterly Jet Overhaul Conference, held recently in Cardiff with B.O.A.C. as hosts, was attended by delegates from nine European airlines—Air France, Lufthansa, K.L.M., Sabena, S.A.S., Swissair, U.A.T. and T.A.I. Problems relating to overhaul processes and test equipment for jet engines and accessories were discussed, with the object of shaping a joint approach to manufacturers. Guest speakers from Greer Hydraulics Inc. and General Electrical Co. of America addressed the meeting; also represented were Bristol Aero Engines and Pratt and Whitney. The next meeting will take place in Paris in December of this year.

RED-LETTER FLIGHT

ACCORDING to Moscow Radio, a new world air speed record was achieved by a Tu-104A recently when it covered a 1,000 km course in 1 hr 1 min 48 sec. The average speed for the flight, with a ten-ton payload, was given as 604 m.p.h., 44.92 m.p.h. inside the existing Swedish-held record. Maximum speed, "reached several times," was reported to be 639.9 m.p.h. The F.A.I. approved record for jet aircraft over a 1,000 km closed circuit, set up on May 19, 1955, is held by Capt. Hans Neij, of the Swedish Air Force, flying a Saab S-29A.

Month by month we have published photographs of the Electra taking shape at Lockheed's California Division at Burbank. Here, in the final assembly hangar, the tail unit has been added and the aircraft is structurally complete. The first Electra for airline service (with Eastern) is now in the fuselage mating dock.

CIVIL AVIATION . . .

BREVITIES

A SUCCESSFUL first proving flight from London to New York non-stop by a B.O.A.C. Britannia 312 (G-AOVB) was made on September 28. The flight took 11 hr 39 min. The aircraft is to fly from New York to Newfoundland and the Caribbean while based for a week or ten days at Ildewild.

* * *

Certification of the Allison 501-D13 (Electra) turboprop engine was confirmed by the C.A.A. on September 12.

* * *

A new passenger services building has been erected for Qantas at Sydney Airport. There will be a staff of 160.

* * *

The Guild of Air Pilots and Air Navigators is to hold its annual general meeting and installation ceremony at the Innholders Hall, College Street, London, E.C.4, on October 16.

* * *

Flight has just received a comprehensive 1965 traffic survey and forecast made by Boeing. A fourfold increase in traffic over 1955 is predicted. We hope to review the study in an early issue.

* * *

The reports that T.W.A. will order the 15 ex-Capital Viscounts plus a further seven were lent added weight by an American report on September 23 that "negotiations" with Vickers are now "almost completed." No confirmation—or denial—is forthcoming from Weybridge at the time of going to press.

* * *

Sheikh Najib Alamuddin, chairman and managing director of Middle East Airlines, has been appointed a member of the I.A.T.A. executive committee for a two-year term. General I. A. Aler of K.L.M. and Mr. Seijiro Yanagita of Japan Airlines have been appointed for two-year terms and Rubem M. Berta of Varig for one year.

Regular once-weekly Tu-104 services between Budapest and Moscow are scheduled to begin on October 8.

* * *

Sabena and J.A.T. are to start regular services between Brussels and Belgrade on October 9. J.A.T. have bought two DC-6Bs.

* * *

The Civil Aviation Administration of China claims that not a single aircraft accident or casualty has occurred in Chinese civil aviation since 1950.

* * *

During their first six months of operation, nearly 3,000 passengers used the S.A.S. North Pole route between Copenhagen and Tokyo. No icing or turbulence was reported on any flight.

* * *

Lufthansa are to start a first-class service on their North Atlantic flights from Germany to Montreal, Chicago and New York *via* Paris or Shannon on November 1.

* * *

I.A.T.A. reports that international business transactions through the Clearing House in London increased by more than 30 per cent between January and June. The turnover was £100,849,000.

* * *

A new booking department to be called Silver City Services, Manx Airlines, Ltd., was opened in Glasgow on October 1. Under British Aviation Services, Manx will increase the frequency of most of their services from Scotland next year.

* * *

Convair are offering the 340/440 with wing-tip jets to increase speed, payload, climb and take-off. Two types of engine are being offered—the Fairchild J54 and the Continental J69. The conversion is reported to cost about $150,000 excluding labour. Two European airlines are reported to be interested.

CLUB AND GLIDING NEWS

A DECISION to purchase a second aircraft, an Auster D, was made at a recent meeting of the Armstrong Siddeley Flying Club. The only snag appears to be the problem of hangar space. At present the club operates Tipsy Trainer G-AFSC.

AT Eastleigh magistrates' court, Mr. Arthur Michael Harris was fined £25 on September 23 and ordered to pay ten guineas costs for "failure to comply with rules of the air and air traffic control at Eastleigh Airport." In a letter to the court Mr. Harris—who had hired an Auster Autocrat from the Midland Aero Club at Elmdon to fly to the Isle of Wight with a friend—stated that they had to turn back when ten miles from Ryde because of low cloud. His primary object in landing at Eastleigh had been "to keep myself and my passenger alive."

THIS year the Airways Aero Club, based at Croydon, celebrates the tenth anniversary of its formation. It began operations in 1948 at Denham, Whitchurch and Hurn, with a Magister and an Aeronca at each centre; now it has ten Chipmunks and three Aiglets, plus two Consuls (on long-term hire) for twin-engine conversions and I.R. training. Over 32,000 hours have been flown; and 123 P.P.L.s, 105 C.P.L.s and 45 I.R.s have been issued.

CIVIL charter and private aircraft may now use 78 R.A.F. aerodromes—compared with the 37 previously available—provided the station commander's permission is obtained before take-off and the usual regulations listed in the U.K. *Air Pilot* are observed. A full list of these airfields has been published in the *Royal Aero Club Gazette* for September and will be given in the October supplement to the *Air Pilot*.

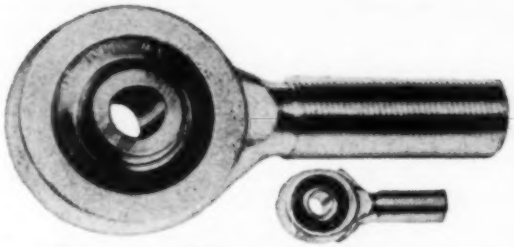
THERE was a good attendance of both aircraft and spectators for the North London Aero Club's competition day at Panshanger on September 15. Two of the four French pilots who attended gained prizes, J. Huberdeau (Stampe) winning the sealed-time arrival competition and J. Camus (Stampe) coming second in the short take-off contest. J. Radley (Tiger Moth) won both short- and forced-landing, and other winners were: C. Stross (Taylorcraft), short take-off; and D. Campbell (T.M.), bombing.

GOOD progress is reported by the Kent Gliding Club, who have added a Cadet and an Olympia to their aircraft strength and are receiving so many applications for flying membership they have had to start a waiting list.

FIGURES published recently by the National Aeronautic Association (the national aero club of the U.S.A.) point a remarkable comparison between sporting and private flying in that country and in Britain. As reproduced in the *R.Ae.C. Gazette* for September (with British totals in brackets) they are as follows:

Total hours flown by private pilots	4,900,000	(90,000
Total hours flown by business pilots	4,600,000	Club and Group)
Total private aircraft (active)	41,688	(439)
Total business aircraft (active)	23,000	
Private pilots' licences issued (estimated)	18,000	(1,380)
Valid P.P.Ls. at 1st July	418,359	(5,773)
Total Airports open to private aviation	6,839	(87)
Gliding:		
Total hours flown	8,195	(15,726)
Gliders owned by individuals	196	(60)
Gliders owned by Clubs	69	(175)

An impressive line-up at Croydon of aircraft used by the Airways Aero Club, whose tenth anniversary is referred to above. One of the club's Chipmunks was away when the photograph was taken; and its third Aiglet is based at Denham.



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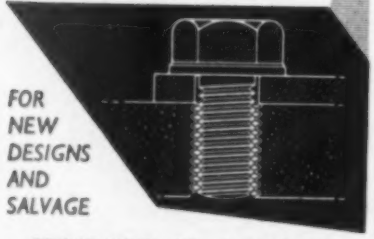

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PUBLIC ANNOUNCEMENTS

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THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM SILVER CITY AIRWAYS, LTD., of 1 Great Cumberland Place, London, W.1:—

APPLICATION No. 76/5 for continued approval until 31st December, 1964, of the Vehicle Ferry Service which they are authorized to operate until 31st December, 1961, with Bristol 170 and Dakota aircraft between Lydd (Ferryfield) and Le Touquet.

APPLICATION No. 202/3 for continued approval until 31st December, 1964, of the Vehicle Ferry Service which they are authorized to operate until 31st December, 1961, with Bristol 170 and Dakota aircraft between Lydd (Ferryfield) and Calais.

APPLICATION No. 470/2. From B.K.S. Air Transport, Ltd., of 1 Marylebone High Street, London, W.1, for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate between Leeds (Yeadon) and Dusseldorf so as to include Brussels as an additional traffic stop.

APPLICATION No. 793/2. From Air Kruise, Ltd., of Lydd, Kent, for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate between Lydd and Lyons, so as to permit an increase in frequency from four to six return flights per week.

APPLICATION No. 35/3. From B.K.S. Air Transport, Ltd., of 1 Marylebone High Street, London, W.1, for an amendment to the terms of approval of the U.K. Internal Service which they are authorized to operate on the route Newcastle and/or Leeds-Guernsey (optional)-Jersey, so as to remove the condition which limits terminating services between Leeds and Jersey to one return flight on each of the days Friday, Saturday and Sunday.

APPLICATION No. 953/2. From Eagle Airways, Ltd., of 40 Edgware Road, London, W.2, for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate with Viscount and Dakota aircraft between Manchester and Ostend, so as to permit them to operate also with Viking aircraft and to increase the frequency of the service from seven to ten return flights per week.

FROM AIRLINES (JERSEY), LTD., of The Airport, St. Peter, Jersey:—

APPLICATION No. 40/7 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate with D.H.89, D.H. Heron and Bristol 170 aircraft on the route London (Croydon or Gatwick)-Southampton (Eastleigh)-Alderney-Guernsey and/or Jersey-St. Brieuc-Lannion-Brest, so as to permit them to operate also with Fokker Friendship and/or Handley Page Herald and/or Viscount aircraft and to operate terminating services in accordance with traffic demand over any sector or sectors of the route.

(Continued at top of column 3)

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PUBLIC ANNOUNCEMENTS

(Continued from column 2)

APPLICATION No. 41/7 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate with D.H.89, D.H. Heron and Bristol 170 aircraft on the route Manchester (Ringway)-Coventry (Baginton)-Bournemouth (Hurn)-Guernsey and/or Jersey-Dinard-Rennes-La Baule and Nantes (optional), so as to permit them to operate also with Fokker Friendship and/or Handley Page Herald and/or Viscount aircraft and to operate terminating services in accordance with traffic demand over any sector or sectors of the route.

APPLICATION No. 42/3 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate with D.H.89, D.H. Heron and Bristol 170 aircraft on the route Exeter-Guernsey-Jersey-Caen-Paris (Orly), so as to permit them to operate also with Fokker Friendship and/or Handley Page Herald and/or Viscount aircraft, and to operate terminating services in accordance with traffic demand on any sector or sectors of the route.

APPLICATION No. 40/8 for permission to integrate services on the routes referred to in Applications Nos. 40/7, 41/7 and 42/3, so as to permit them to operate terminating services, in accordance with traffic demand, between Exeter and Dinard, Exeter and St. Brieuc and Southampton and Dinard.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the ground that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [7146

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A. L. Hutchinson,
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[7154

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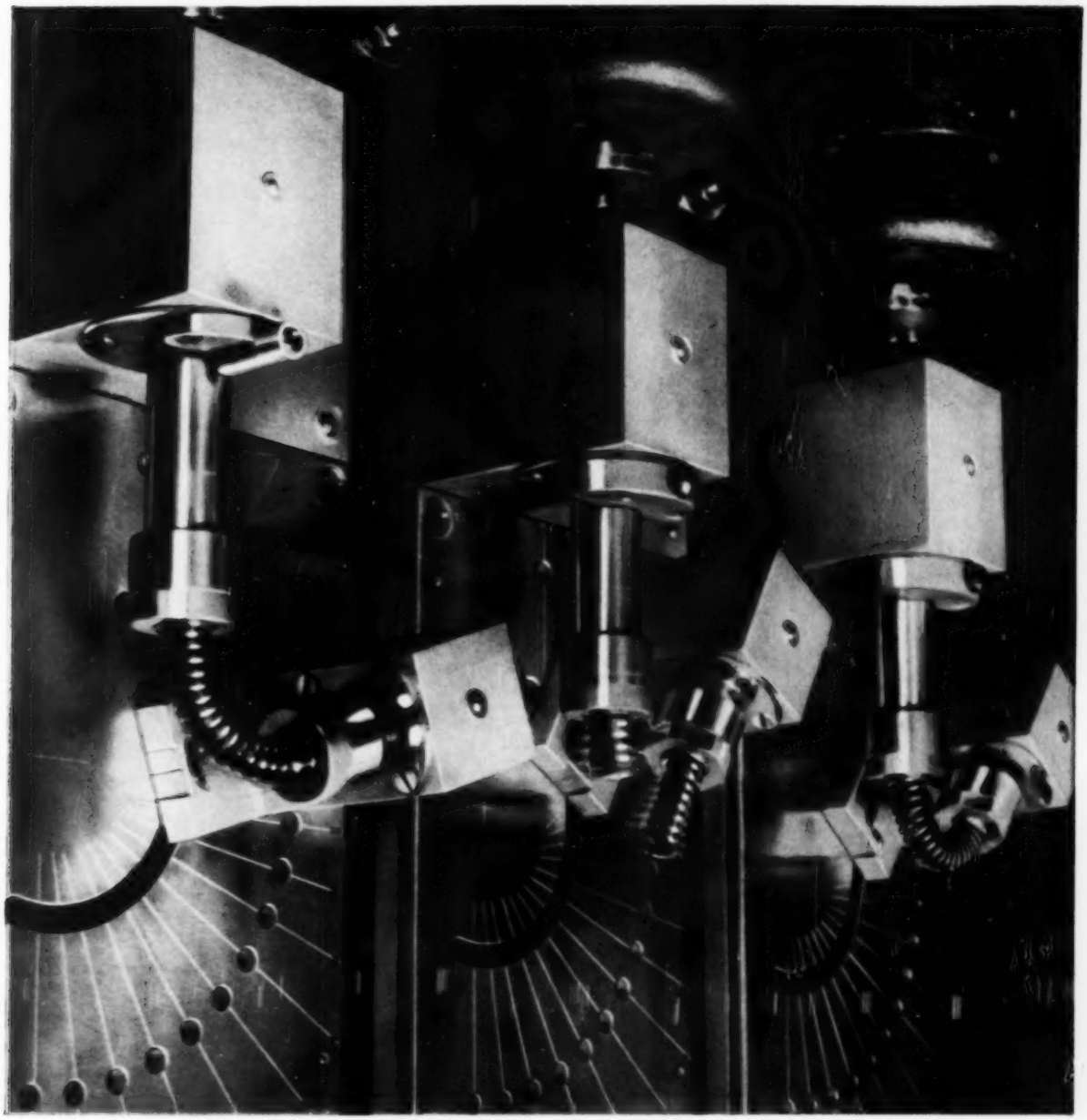

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